SCIENTIFIC AMERICAN

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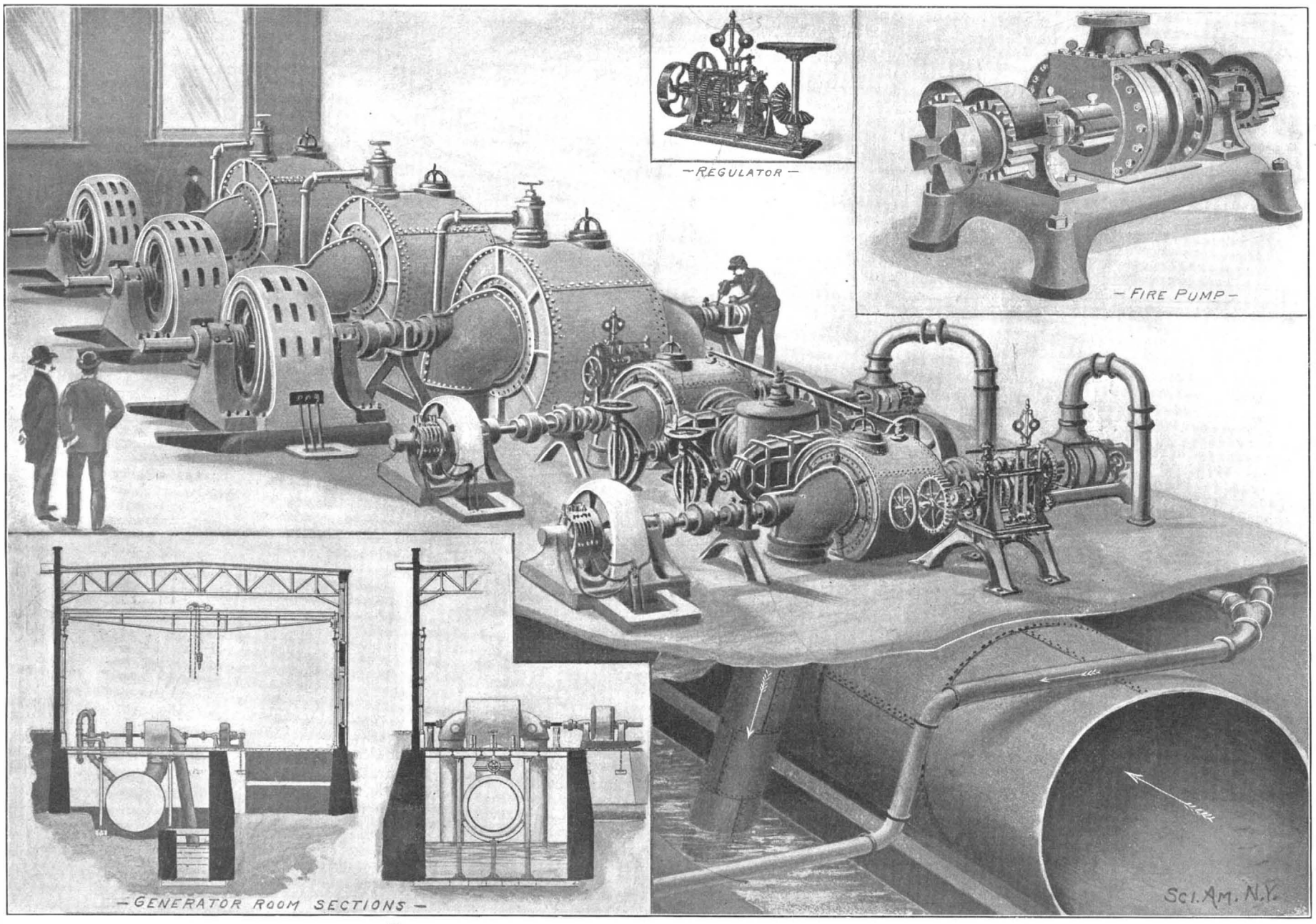

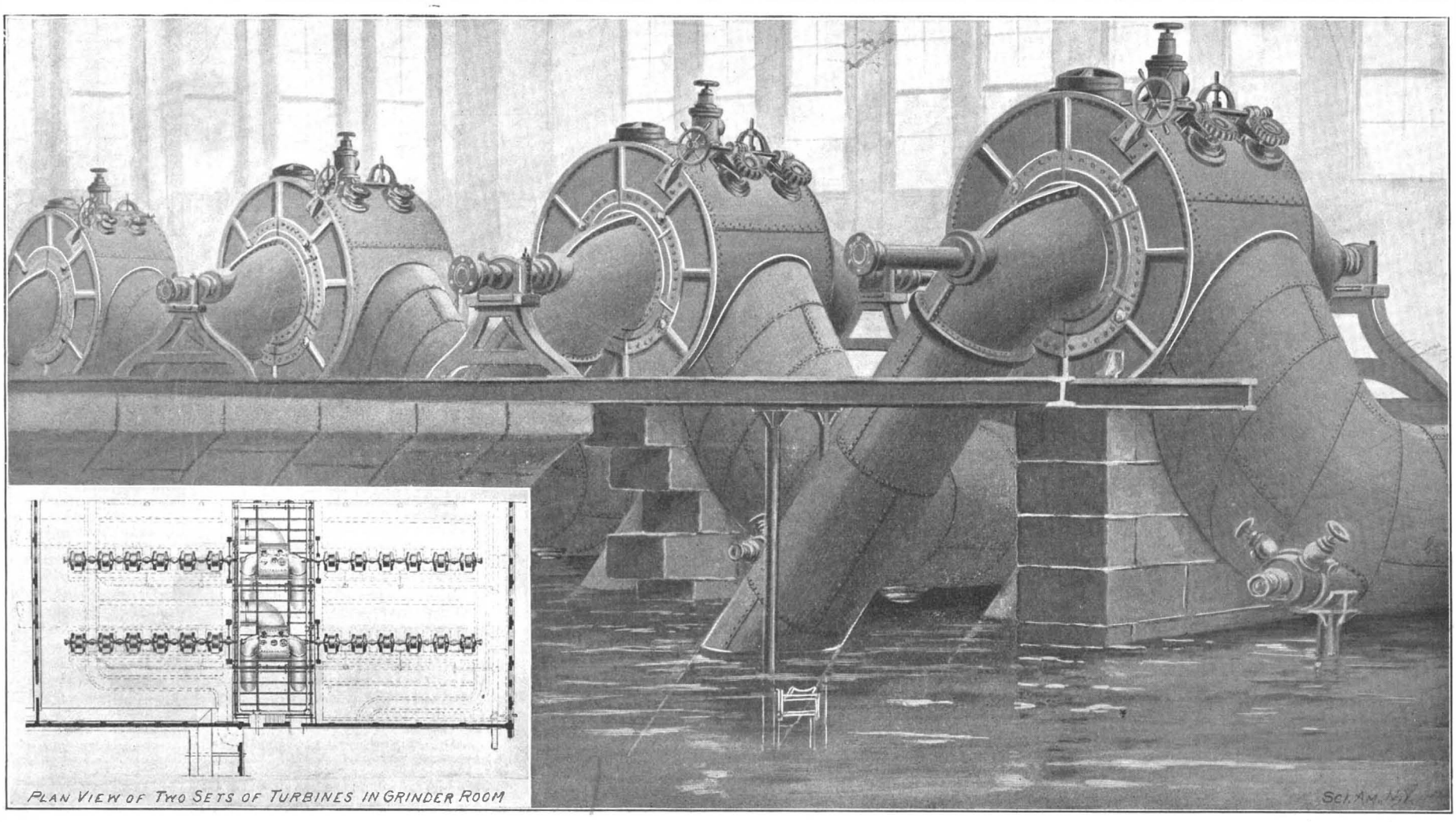

RODNEY HUNT TURBINE PLANT AT THE GREAT NORTHERN PAPER COMPANY'S MILL, MILLINOCKET, MAINE—GENERATOR AND GRINDER ROOMS.—[See page 230.]

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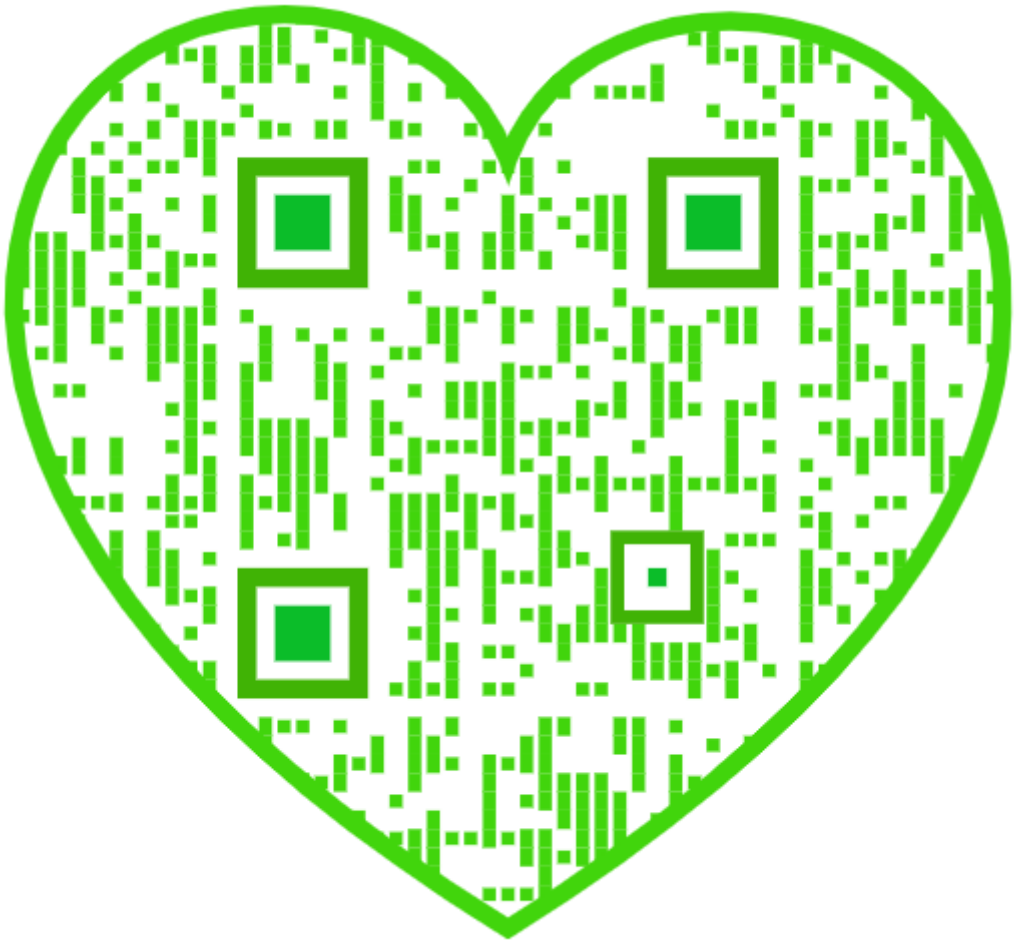

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NEW YORK, SATURDAY, APRIL 13, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE BROOKLYN RAPID TRANSIT EXTENSION.

The citizens of New York will approve the stand taken by President Orr, of the Rapid Transit Commission, in regard to the proposal, more ambitious than tangible, of Mr. Johnson to build an extension of the subway system through South Brooklyn to Fort Hamilton, and across Staten Island to a junction with his proposed Philadelphia and New York trolley line. Mr. Johnson may be perfectly sincere in his intentions, and, for all we know, may have the necessary ability and capital to do everything that he promises; but he has certainly failed, thus far, to place his proposal before the Rapid Transit Commission in such a practical form as would justify that body in taking it into serious consideration.

In a communication to the Railroad Committee of the Municipal Council, and the Chairman of the Committee on Streets and Highways of the Board of Aldermen, President Orr says that the difficulties in the way of laying out and offering at public letting any such road as Mr. Johnson describes, are two: First, that at the present time the city cannot afford to borrow for rapid transit purposes more than $8,000,000, which sum the Rapid Transit Board is advised by its engineers will probably suffice to extend the railway beneath the East River to the Borough Hall and Flatbush Avenue. Such a road as Mr. Johnson describes would probably cost in the neighborhood of $24,000,000, and in view of the possible difficulties in tunneling beneath the Narrows, might cost a great deal more. President Orr points out, secondly, the uncertainty as to securing a bidder, since Mr. Johnson does not positively say that he will bid for or build a road on the lines he suggests. With regard to Mr. Johnson's statement that he is able and willing to carry passengers for three-cent fares within the city limits, Mr. Orr's letter pertinently suggests that if the Municipal Assembly will approve the plans of the Rapid Transit Commission, and the contract is put up for public letting, Mr. Johnson may bid, and include in his proposal the offer for a three-cent fare, that being the proper time and the proper way to have such an offer considered.

In its treatment of this latest proposition, the Rapid Transit Commission has shown the discretion which has been a marked feature in its very successful handling of the great problem before it. With over twenty miles of tunnel road under contract, and a proposed extension to cost $8,000,000, we think that the only possible course for the Commission is the rejection of a scheme so extravagant and immature as this Staten Island proposal. Some day in the future, the Rapid Transit system will be extended through South Brooklyn and beneath the Narrows to reach the large suburban population on Staten Island; but the time is not yet come.

A STEP BACKWARD.

When the last Congress adjourned without making any provision for new battleships and cruisers—the first time such an omission has been made in ten years—the United States Navy was set back among the growing navies of the world by just twelve months in time, and by exactly the number of battleships and cruisers which represents the average annual addition, that should be made at this time to our navy, if we are to maintain even our present relative standing among the world's powers.

It is at all times the risk and, as the last Congress has proved, may be at any time the misfortune, of a country the question of whose naval increase is absolutely in the control of laymen, that the additions to the navy, both as regards the numbers and the types of new ships, may be made with very little, if any, reference to the pressing needs of the hour, or to a carefully-thought-out programme, whose provisions are based upon a farsighted and statesmanlike view both of the present trend of events and of the probable developments of the future. Whether we like the thought or not, we are boldly launched upon the tempestuous sea of international politics; for the possession of the far-distant Philippines has rendered us ten-fold more open to attack by a naval power than we were before the first gun of the Spanish-American war was fired. With other naval powers bending every effort to increase their fleets, to reorganize their personnel, and maintain their standing as to number and efficiency, the failure of Congress to authorize a single battleship or cruiser becomes doubly deplorable. Are the country's representatives perhaps without the necessary technical advice as to the requirements of the navy? We think not; for there is in Washington a board composed of leading officers of the line and staff whose special duty it is to keep Congress informed as to the naval situation, and our particular requirements as a naval power, and these requirements are regularly placed before Congress in an annual report of the Board. The plea of ignorance, therefore, cannot be urged; and one is driven to the conclusion either that Congressmen are guilty of amazing indifference, or that they are willing to make the interests of the navy, which are just now, or may soon become, the most vital interests of the country, the sport of contending political factions.

Two years ago the Scientific American showed in a careful analysis of the seven leading naval powers of the world that the United States came fourth, with Germany as a very close competitor. It was pointed out at the time that, whereas the increase of our navy depended upon the caprice of Congress and might be great or little according to the temper of that body in each particular year, the Germans, with characteristic method and thoroughness, had conceived and were carrying out a programme of construction, which was to extend over a couple of decades and insure that a certain number of ships would be commenced and a certain number completed each year. Since then Germany has not only been steadily at work upon this programme, but she has drawn up and committed herself to a second or even more ambitious programme. The two schemes together have already placed that power on a par with ourselves; and by next year, thanks to Congress, we shall have taken the fifth position with the prospect of being steadily outdistanced by a power whose trade and spheres of influence in the South American Continent are growing by leaps and bounds.

LAKE VESSELS FOR THE ATLANTIC TRADE.

Some years ago it was confidently expected that the whaleback type of vessels which has done so much for navigation on the Lakes, would eventually become a factor in the Atlantic trade, and although a number of vessels of this type entered into the ocean trade some years ago, and have met with no little success, they have not made the advancement in the ocean trade that had been hoped for this type of vessels. Whaleback barges owned by Rockefeller are now, however, en route to Europe, having refitted at New York for the sea service.

Of the ten vessels under construction in Lake shipyards for the Atlantic service four are practically completed. These are owned by the International Steamship Company, a concern organized early in the year. These four vessels will serve as freight carriers between New York, Cuba, Porto Rico, and South America. Four steamers are under construction at South Chicago for a syndicate composed of New York and Chicago capitalists, and they will form the nucleus of a big fleet of carriers which will engage in the packet freight and grain trade between Chicago and Liverpool. Owing to the limitations of the Canadian canals connecting the Lakes with tide water all the vessels being built at Lake shipyards for ocean service are about 250 feet in length, but all interested in Lake shipping are hoping for the time when American canals of a greater capacity will be opened.

The new vessels of the International Steamship Company afford good examples of the Lake craft now being constructed for the Atlantic trade. These vessels have a length of 256 feet over all and a length on keel of 252 feet. The molded breadth of the steel hull is 42 feet, and the molded depth is 26 feet 5 inches. These vessels are fitted with quadruple expansion engines, with cylinders 15, 23, 35 and 54 inches in diameter, which will be supplied with steam by two Babcock & Wilcox water tube boilers, with a steam pressure of 250 pounds. The argument of builders of regular ocean craft that a vessel's machinery must be located amidships is disputed by the builders of Lake vessels, and the boilers and engines of all these Lake craft for the Atlantic trade will be located aft, and thus, by the special hull construction, they will be able to carry larger cargoes than the regular ocean vessels of like draught. By thus carrying the same cargo as is now carried by regular ocean craft of greater draught these ocean-going vessels will be able to discharge cargoes at those ports, where lightering systems are now in vogue, without the use of lighters, and thus they hope to outbid the regular sea-going craft for such trade.

The "Tampico" and the "Eureka," two first-class steel ships which traded on the Lakes during the season just closed, are on the coast. They are sister ships and models of their type. As they possess a very large carrying capacity they can be operated at a comparatively small expense. The "Simon J. Murphy" is another type of Lake ocean-going vessel which was built last summer. The Rockefeller interests, among other large Lake shipping concerns, will now give the Atlantic shipping business a thorough test, and in case there is a reasonable chance of profit a large fleet of these boats, many of them of the whaleback type, will be sent to the coast next fall. The Carnegie Steel Company, Limited, last year dispatched the steamer "Monkshaven" from Conneaut, Ohio, to England, laden with a cargo of 1,001 tons of steel billets, this being the first Lake vessel to carry the product of this great iron and steel firm abroad. After passing the Canadian locks she took on a shipment of pulp wood. Were it not for the locks she could carry direct from the Lakes 2,000 tons of steel The Carnegie Company have under construction a number of vessels which are being built with a view to engaging in the ocean carrying trade, and it is now proposed to ship much of the product of this great manufacturing concern to Europe via the Lakes. The vessels being constructed by the Carnegie Company will engage in the ore-carrying trade during the open season on the Lakes, and in the winter will be dispatched with cargoes of finished product to Europe, and, during the season, will ply regularly between the Atlantic coast and European ports, and thus carry much of the trade of the Carnegie Company now shipped by the regular ocean lines.

GOVERNMENT ECLIPSE EXPEDITION.

BY MARY PROCTOR.

The Government Eclipse Expedition sailed from San Francisco for Sumatra on February 16, on the transport "Sheridan," which will take the members as far as Manila. There a man-of-war from the Asiatic station will be set apart for their use during the remainder of the trip as far as Padang, in the island of Sumatra. The expedition is sent for the purpose of observing the total eclipse of the sun which occurs May 17, 1901.

The entire expedition has been planned and the preparations carried out under the personal direction of Prof. S. J. Brown, Director of the United States Naval Observatory, Washington, D. C. However, he was unable to accompany the expedition, which is consequently placed in charge of Prof. A. N. Skinner, of the Naval Observatory.

The names of the astronomers who are to accompany the expedition are as follows: Prof. A. N. Skinner; Prof. W. S. Eichelberger, assistant astronomer; Prof. F. B. Littell, G. W. Peters, L. E. Jewell, and W. W. Dinwiddie, of the United States Naval Observatory staff.

From the other observatories are Prof. E. C. Barnard, of the Yerkes Observatory; Dr. W. J. Humphreys, of the University of Virginia; Dr. S. A. Mitchell, of Columbia University, N. Y.; Dr. N. E. Gilbert, of Johns Hopkins University; Dr. H. H. Curtis, formerly of the Lick Observatory, now assistant in the Leander McCormick Observatory.

The "Sheridan" was expected to reach Manila by the middle of March, and Padang by the first of April, leaving nearly two months for preliminary operations in Sumatra. This is of special value, since there may be many difficulties to overcome with regard to the transportation of instruments and in making a careful search for desirable locations for the observing-stations, which are to be distributed along the shadow-path. As soon as these important facts are determined, the instruments will be assigned to the different observers and set up in place.

According to the programme arranged by Prof. S. J. Brown, the work will consist of photographic, spectroscopic, and polariscopic observations, in addition to the usual visual work. Prof. Bernard will be stationed at Solok, near the central line, and expects to photograph the corona on a large scale. He will use the cœlostat which he employed so successfully at the last eclipse, besides using smaller apparatus.

At Fort de Kock, near the northern border of the shadow-path, Mr. Peters will occupy a position, using the 40-foot photoheliograph lenses of the Naval Observatory, two of which gave very fine results at the last eclipse when used at Barnesville and Winnsboro. Two other photographic instruments will be used to test the value of photographing with visual lenses, using some form of screen to cut out the violet light. The results at Barnesville in this direction were so successful at the last eclipse that they show that this method

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for the study of the greatest extension of the coronal streamers is of much value.

As in the last eclipse, the spectroscopic investigations will be carried on entirely by grating, concave and flat. Dr. S. A. Mitchell will occupy a position at the central station, and will use the objective grating with which such successful results were obtained at the last eclipse. Mr. Littell will take charge of another objective grating, using a very long slit, with which it is expected to obtain some light on the rotation of the corona, as the length of the slit is sufficient to take in the disk of the moon and the brighter portions of the corona.

Mr. Jewell and Dr. Humphreys will use a concave grating of 30 feet focal length and a ruled space of 3½ x 3 inches, which has just been constructed by the Johns Hopkins University. It will be used without a slit, and as Dr. Humphreys and Mr. Jewell expect to occupy a position near the northern border of the shadow-path, where the duration of the reversing layer will be several seconds, the concave grating used by these observers is expected to yield results of unusual value. Mr. Jewell will also take charge of a concave grating of 10 feet focal length, and a photographic instrument in which a visual lens will be utilized.

The character of this particular eclipse is well shown by the fact that although this station will be located within seven miles of the northern border, the duration of totality is over three minutes, more than twice as long as the duration of totality at the central line of the eclipse in 1900.

Dr. N. E. Gilbert has the important task of looking after an instrument loaned to the expedition by the University of Wisconsin. It consists of a combination of a spectrum and Nicol prism, by means of which only the reflected light of the corona will be admitted on to the photographic plate. This will be used at the suggestion of Prof. R. W. Wood, of the University of Wisconsin, who has made certain interesting investigations with regard to the possibility of securing reliable records of the Fraunhofer lines in the spectrum of the corona. According to his theory, they ought to be found there, but for some reason it has been impossible to secure reliable records of their presence there.

Dr. Wood believes it is possible to detect the presence of these lines in the spectrum of the corona, basing his supposition on the fact that the light emitted by the particles in virtue of their incandescence so overpowers the reflected sunlight that the lines are invisible. That the coronal light is strongly polarized is well known, and there is scarcely any doubt that the polarized light is reflected sunlight. To quote Dr. Wood's remarks, in Science for February 1, 1901:

"If now a Nicol prism be placed before a slit of the spectroscope in such a position as to transmit the polarized radiations, these will be allowed to pass with almost undiminished intensity, while the emitted or unpolarized light will be reduced in intensity by one-half. The great change in the ratio resulting might easily be sufficient to bring out the dark lines distinctly. I feel firmly convinced that the experiment should be tried at the Sumatra eclipse of next May, for I have successfully accomplished it in the laboratory with an artificial corona."

Thus we see that eclipse work of the present day includes in its programme a study of the coronal light, the record and measurement of the bright coronal lines, and their identification, if possible, with terrestrial elements, and the distribution in the corona and round the sun of the various bright lines of the coronal spectrum, and especially of the bright line "coronium."

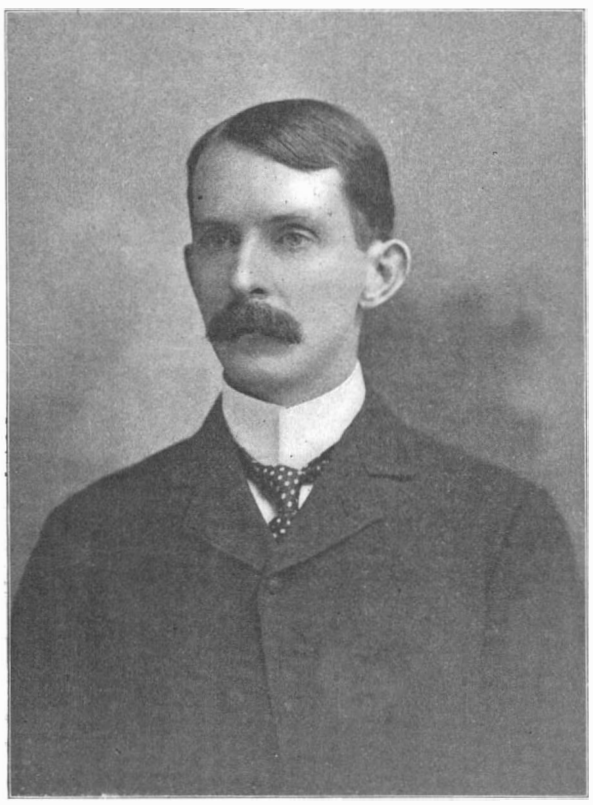
This May is the first time the United States Naval Observatory has sent an expedition to observe a total eclipse of the sun since 1878. Let us hope success may attend the present Government Eclipse Expedition, and that an important advance may be made in connection with the study of the corona, and especially as to the best methods and instrumental means for future research.

ELECTRICAL PROTECTION OF THE MAILS.

The Post Office Department is utilizing all means to insure the security of mail matter, and it may not be generally known that the government conducts from time to time tests of inventions designed with this end in view. The Post Office has suffered considerable losses by organized thieves who were dressed in uniform like government mail collectors and provided with duplicate keys. An electrical device for protecting the letter boxes is now being tested. A number of mail boxes with locks electrically controlled have been installed on one of the mail routes in the business section of the capital, says The Western Electrician. The electrical locking devices are under the control of an operator at the central station in the Post Office where there is a clock, similar in appearance to the ordinary watchman's clock, provided with a mechanism which prints the numbers of the mail boxes when they are opened and when they are closed. The first box must invariably be visited first by the collector, as this box controls the operation of the lock of box number 2, box number 2 of number 3 and so on. After allowing the mail collector time to reach the first box, the operator at the central station presses a button which releases a secondary locking device, and allows the carrier's key to throw the lock bolt. The opening of this box performs the same service for box number 2 as that performed by the operator at the central station; that is, sets automatically the lock for the collector's key to open. Since succeeding boxes are set by the one last opened, it is obvious that the predetermined order of visitation by the collector must be strictly adhered to. The act of opening and closing each mail box is instantly recorded on a time dial at "Central," and in case of unlawful attempts being made to open them Central is instantly notified of "trouble on route" by the ringing of an electric bell. Should the occasion arise when the collector desires to communicate with the operator at Central, he can do so by pressing a button at any mail box, a prearranged code of signals permitting the sending of a few important messages.

THE NEW COMMISSIONER OF PATENTS.

Frederick Innes Allen, the new Commissioner of Patents, was born in Auburn, N. Y., January 19, 1859. He comes from New England stock, being a direct descendant of George Allen, who landed with the Weymouth party from England in 1636, and settled at Weymouth, Mass. The head of the branch of the family from which the Commissioner is descended was one of the founders of the town of Sandwich,



F. I. Allen

Commissioner of Patents.

Mass., the first town of the Plymouth colony upon Cape Cod.

Mr. Allen's father was William Allen, who for many years was prominently and actively engaged in the practice of patent law. He was a contemporary of, and associated with, such great patent practitioners as Blatchford, Gifford, Harding, and other authorities upon patent law of a generation ago. He was the managing attorney of the combination of reaper patent owners who controlled the manufacture of harvesters in the United States forty years ago, and which was the largest combination of the time.

Commissioner Allen was educated at the Auburn High School and Phillips Academy, Andover, and graduated from the Sheffield Scientific School of Yale with the class of '79.

He then took up the study of law, and was admitted to practice in 1882. His natural inclination was to patent law, and he at once began the study of this special branch of his profession. He has been eminently successful in his practice.

While he has always been a diligent student of the law, Mr. Allen has found time to acquaint himself with a wide range of topics, and few men have more general information upon a greater variety of subjects. He has been a special student upon naval and ordnance construction, and he has given a number of entertaining and instructive addresses upon these subjects. Mr. Allen also excels as a mineralogist. While at Yale he took the class prize for geological and mineralogical study. He has never lost interest in the subjects and his collection of specimens is large and complete.

Mr. Allen is a man of dignified appearance and pleasant manners. He gives one the impression of being a man of strength and firmness coupled with that breadth of view which is so absolutely essential in any one holding a position requiring as diversified talents as a Commissioner of Patents. He has, by education and experience, a thorough knowledge of the patent practice, and there is no reason why he should not soon acquire a thorough understanding of the inner workings and special needs of the Patent Office. We are happy to extend to him our congratulations upon his appointment to this most important trust.

THE NEW YORK BOTANICAL GARDEN MUSEUM.

The museum stands on a commanding site near the Bedford Park entrance to the garden. Looked at from the south, it is an imposing building. The walls are a gray white; they rise in four high stories, and the center has a dome. The Corinthian columns at the portico, and the stone balustrade at the outer side approach contribute to the substantial elegance of the structure.

The practical information now to be gained in the garden is mainly to be obtained in the museum, and at the same time, no small measure of pleasure. In the work rooms in the basement, quantities of unmounted specimens of plants are being put into order. The young men at work upon them spread upon a large thick sheet of glass, a coating of Dennison's glue diluted with vinegar. Upon this, the dried specimen is laid for an instant; then it is touched upon a sheet of porous paper that the unneeded glue may be absorbed; from this, it is laid upon the permanent cardboard, which already bears a printed label. After being kept under pressure for two or three days, the specimens are strapped in two or three places, and thus are perfectly secure.

One of the students at work gave a hint in regard to the preservation of the color of flowers, worth noting here. It has been found that if the specimens, after being under pressure for a day or two, are laid in papers heated in the sun, until their drying is complete, the color is preserved as by no other process.

The first floor contains the collections illustrating economic botany. They are beautifully arranged and are deeply interesting. Each case tells a volume. For example, one showing pine products contains a section of the trunk of a Georgia pine, cut as such trees are when the turpentine is collected. Beside it are jars of turpentine and tar in various degrees of density, with lumps of resin. Close at hand are specimens of soaps in which tar or resin has been used.

The cocoa bean, cotton, cork, tea, the grains, hemp and the rest of the vegetable products upon which we depend, are represented with equal detail in the collection. One case of special interest is that devoted to sedge-fiber products made by the Northwestern Grass Twine Company, of St. Paul. The fabric is called *iyotan*. The samples of carpets, rugs and cushions of soft greens and grays into which the grasses are woven are very agreeable in color, and look durable.

The next floor is devoted to the illustration of systematic botany in a manner at once interesting and instructive. Each of the large cases is devoted to one family of plants, or to closely allied groups. For example, the *Polypodiaceae* may be named. Its 3,000 species are represented by specimens of fossil ferns from coal measures, a section of a large tropical tree fern, roots in jars of alcohol, as well as dried ferns mounted, and cuts of microscopic preparations of sections of ferns.

Between the upright cases, swinging cases on standards are arranged. These contain dried specimens of a great variety of plants, arranged, apparently, rather with reference to making the room attractive than to their classification.

This collection and the one below are of deep interest and calculated to inspire children who see them with an enthusiastic love of botany as it may now be studied. A day in this museum with most people would do more in this direction than years of study according to the old methods when the science consisted mainly in the identification and classification of flowering plants.

The top floor of the building is not open to the general public. The beautiful laboratories there, physiological, taxonomic, chemical, and embryological, are used both by graduate students of Columbia and the garden students, and here they carry on original work in all these departments of botany. They have access to the botanical library of about 8,000 volumes, and to the immense herbaria belonging to both institutions. The plants are arranged in cases, and classified according to Engler and Prautl's system. In such a working-place as this many of Nature's remaining secrets ought surely to be discovered.

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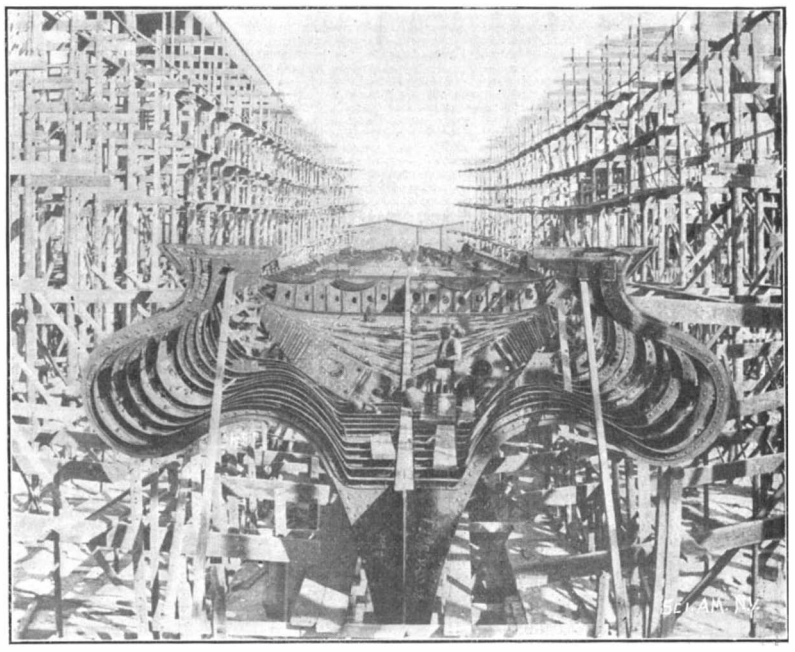
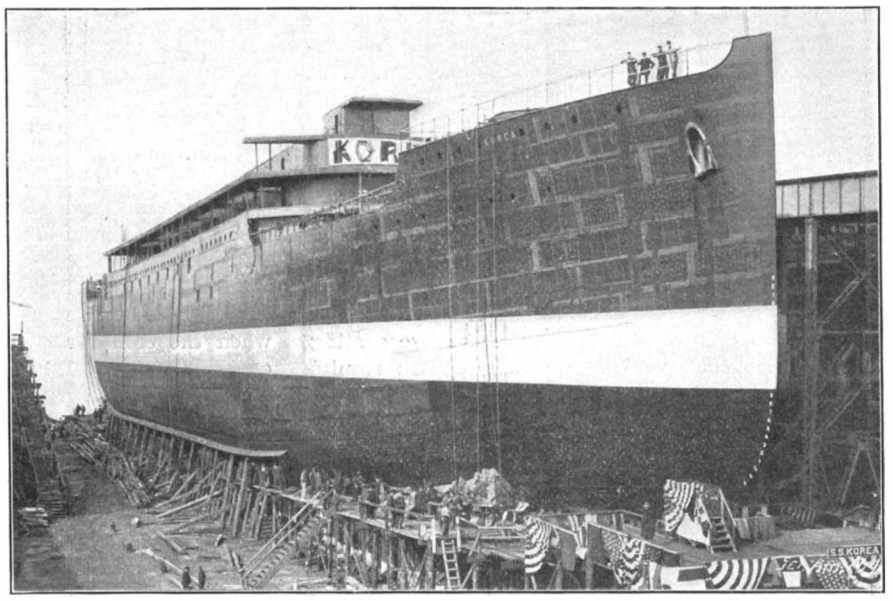
LAUNCH OF THE PACIFIC MAIL LINER "KOREA."

The handsome passenger and freight liner "Korea" which is the largest steamship ever built in America, was successfully launched at the works of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., Saturday, March 23. The "Korea" will ply between San Francisco and Hong Kong, stopping at the ports of Honolulu, Yokohama, and Nagasaki. Besides her great freight capacity, she will have accommodations for 300 first-class passengers, 30 steerage, and 1,200 Chinese. The Chinese quarters are so fitted that the space may be used for cargo if unoccupied by Chinese. The cost of the "Korea" is $2,000,000, and her contract speed is 18 knots.



STERN VIEW, SHOWING SPECTACLE FRAMING FOR PROPELLER SHAFTING.



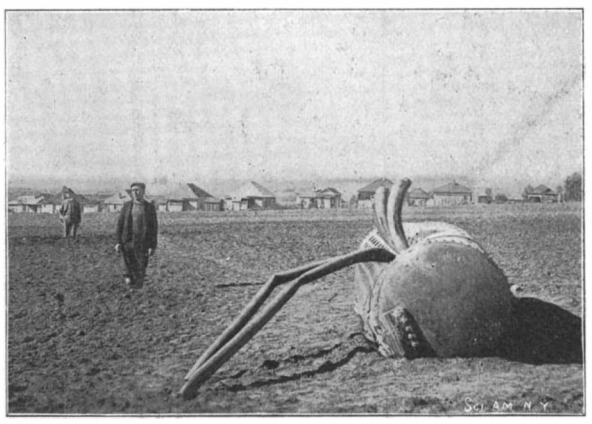
Length over all, 572 feet 4 inches. **Beam,** 63 feet. **Depth to upper deck,** 40 feet. **Displacement,** 18,600 tons. **Horse power,** 18,000. **Speed,** 18 knots.

LAUNCH OF THE PACIFIC MAIL LINER "KOREA," AT NEWPORT NEWS.
(The largest ship built in the United States.)

The principal dimensions of the vessels are as follows: Length over all, 572 feet 4 inches; length between perpendiculars, 550 feet; beam, 63 feet; depth, 40 feet to upper deck; draft, 27 feet; displacement, 18,600 tons. The hull is of steel, with frames spaced 32 inches throughout. The double bottom runs the entire length of the ship and extends to the turn of the bilge. The decks, in their order, are called the orlop, lower, main, upper, promenade, and boat. The lower, main, and upper decks extend the full length of the ship, while the promenade is on a level with the forecastle and poop.

The vessel is fitted with two sets of quadruple-expansion, four-cylinder, vertical inverted engines, with cylinders 35, 50, 70, and 100 inches in diameter and 66 inches stroke. They are designed to develop 9,000 indicated horse power each, at 86 revolutions per minute. The order of the cylinders from forward is high pressure, low pressure, second intermediate, and first intermediate. The engine framing consists of cast-steel housings of I section, bolted to the cylinders and bed-plate, four to each cylinder. The crosshead guides are of cast iron and bolted to the housings. The bed-plates are also of cast steel of I section. Piston valves are used on all cylinders. The piston rods, connecting-rods, valve stems, eccentric rods, and shafting are of forged steel. The crosshead slippers are of cast iron, lined with Parsons' white metal, which is used for all bearing surfaces throughout the engines. The pistons are cast steel, dished. The crank shaft is made in four interchangeable parts, and is 19½ inches in diameter, with a 6-inch hole. Two of the eccentrics, which are of cast iron, are fitted over couplings, while the others are keyed to the shaft. The reversing engine is of the steam and hydraulic type, with steam cylinder 9 inches in diameter, oil cylinder 5 inches in diameter, and a stroke of 20 inches. The thrust bearings are of the horseshoe type, with fourteen collars each. The propeller shaft is fitted with composition sleeves where it works in the stern bearings of lignum-vitæ. The propellers are three-bladed, 19 feet in diameter by 25 feet pitch. The blades are of manganese bronze, and the hub is of cast steel. The main condensers are cylindrical, 7 feet 2½ inches in diameter and 15 feet long between tube-sheets, with a combined cooling surface of 11,787 square feet. Each condenser will have an independent air pump and two circulating pumps. There will also be two auxiliary condensers with combined air and circulating pumps.

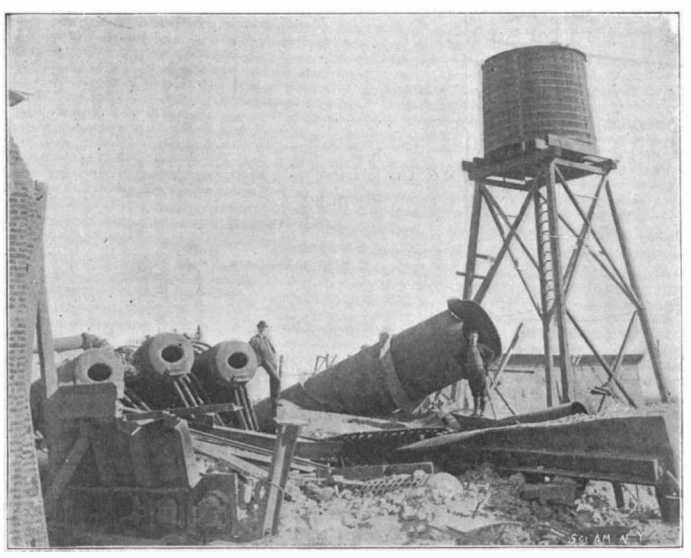
Steam is furnished by six double-ended and two single-ended Scotch boilers, 16 feet in diameter and 20 feet 3 inches and 10 feet 5¼ inches long, respectively, working at a pressure of 200 pounds. They are placed in two watertight compartments. The double-ended boilers have eight furnaces, and the single-ended four. Their total heating surface is 44,912 square feet, and grate surface 1,072 square feet. Forced draft is furnished by thirteen blowers. There is also a donkey boiler on the upper deck, of the cylindrical, upright type.



DOME THROWN 1,768 FEET FROM BOILER SETTING

The particulars of the launching ways are as follows: Length of ways, 690 feet; width of ways, 4 feet; distance between ground ways, 23 feet; grade of ways, ⅝ inch to 1 foot; grade of keel, ½ inch to 1 foot. The launching weight of the vessel was 7,000 tons. The pressure per square foot on the ways was two tons.

The "Siberia," which is a sister ship to the "Korea," will be launched in about two months.



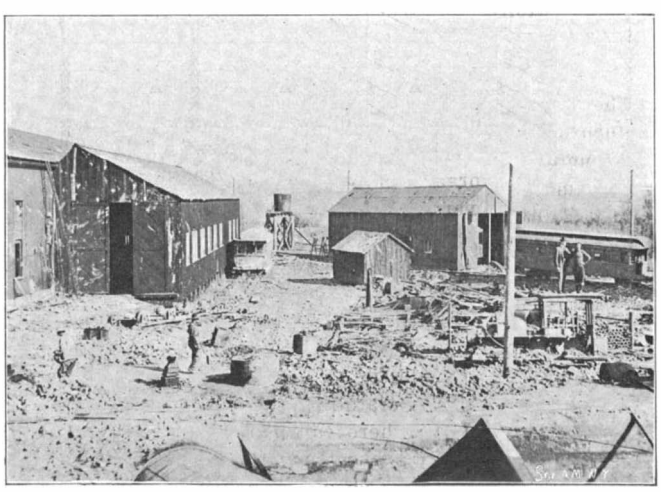
VIEW OF PART OF WRECKED PLANT SHOWING DRUMS.

AN INTERESTING BOILER EXPLOSION.

Our engravings represent an interesting boiler explosion which occurred at Sherman, a small place between Los Angeles and Santa Monica, Cal., on the Pasadena and Pacific Electric Railway Company's lines and in the power plant of the company. The accident occurred on the 5th of December, 1900.

The boiler was of the water-tube type, made by the Stirling Company, being one of a battery in the plant of the railway company at Sherman. This was the second, and by far the worst, explosion of this type of boiler in the plant within three months. This special battery was of 2,500 horse power, and the boiler which exploded had been in use five years. The explosion occurred at 2:45 A. M.; the shock was felt over a wide area, and was distinctly heard at Los Angeles, ten miles away. Our engravings give an idea of the widespread destruction caused by the explosion. Walls of solid brick 40 feet long and 2 feet thick were converted into débris, and piles of wreckage were to be seen everywhere. Corrugated roofing was blown away, and three steel drums, each 16 feet long and 3 feet in diameter, were lifted bodily and hurled to far-distant points. The power house rests on the side of the foothills, which at this point have a rise of 150 to 200 feet to the mile. Two of the drums seem to have taken a general course up this incline toward the mountain. One passed over two rows of cottages, and just missing one, landed on and demolished a shed and outbuildings, landing just 556 feet in an air-line from the starting point; while another, taking the same course, passed over two more rows of cottages, depositing water tubes, etc., along its route, and throwing them through roofs and side walls of the dwellings along its course. It landed 1,768 feet from its original site. The power plant was, of course, tied up by the explosion, and power had to be obtained from other sources. The boiler which exploded in December was not the same one which exploded several months earlier. That one was being repaired, and had not yet been put into use; it was a newer boiler than the others. After the first explosion, and at the request of the railway company, the superintendent of the works in which the boiler was built went to Los Angeles for the purpose of ascertaining, if possible, the cause of the explosion. He made a close examination of the other boilers, and pronounced them in good condition. There was, therefore, no reason to suspect that there was any defect in any part of their battery.

Reports have been made on the accident, which occurred on September 10, 1900, in which the middle drum of one of the boilers was ruptured. It was found that the pressure carried was from 170 to 175 pounds, while the boilers were not designed for a working pressure of more than 150 pounds. This necessitated the screwing down of the safety valves to such an extent as to entirely destroy their efficiency; in fact, after having been screwed down to 175 pounds all the elasticity of the springs was gone. The mud drums were bricked in solidly, thus depriving them of freedom of movement to allow for expansion and contraction. The standard method of introducing feed-water into the rear upper drum was abandoned, and in its place a series of pipes or nozzles was placed in the mud drum, no means, however, being



DAMAGE DONE BY BOILER EXPLOSION, SHOWING LOCOMOTIVE WHICH WAS COMPLETELY STRIPPED.

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provided for removing any deposit that accumulated in these pipes or nozzles. The low-water alarm whistles were found to have been gagged so that, no matter how low the water became, the whistles could not sound. The arrangement of the steam main was also faulty, as it kept up a continual vibration. Possibly the explosion of the boiler in December was due to one of these causes.

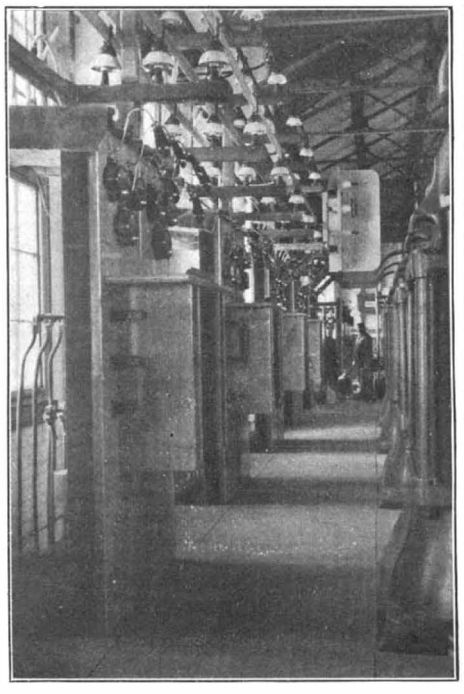
RECENT DEVELOPMENTS AT THE NIAGARA FALLS POWER PLANT.

BY ARTHUR B. WEEKS.

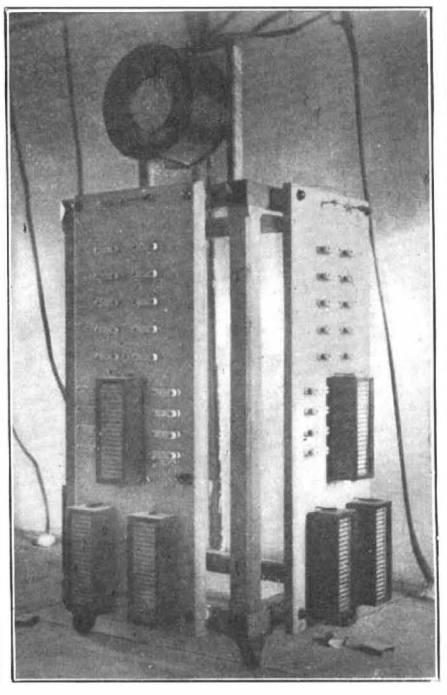
Perhaps the most interesting of late improvements at the great power plant on the upper Niagara is the completed aluminium transmission line to Buffalo, by means of which electric current will be sent to the Pan-American Exposition for all the manifold purposes for which electricity will be brought into use. Not the least noteworthy, also, are the changes in the lightning arrester apparatus, together with the installation of circuit-breakers on the 22 kilo-volt line.

These lightning arresters (Fig. 2) are made by the Westinghouse Electric and Manufacturing Company. The spark gaps for each of the three lines are on marble slabs, upon three sides of a wooden frame set on rollers. Thus, in case of total disability, the lightning arrester may be rolled out and another substituted for it.

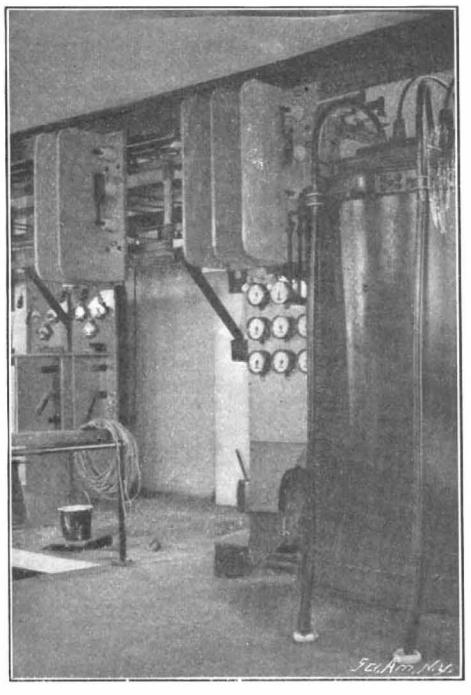
A three-phase General Electric electrostatic ground detector surmounts each lightning arrester frame. At the top of each marble slab is an auxiliary air gap, set according to the line voltage. For 25,000 volts, the gap is one-fourth inch; for 23,000 volts, one-eighth inch; while for 21,000 volts there is no gap. Below this auxiliary air gap are other gaps and resistances, and the ground connection beneath from the last panel connection. The frame is of thoroughly-dried wood, while glass or porcelain is recommended for the upper end.



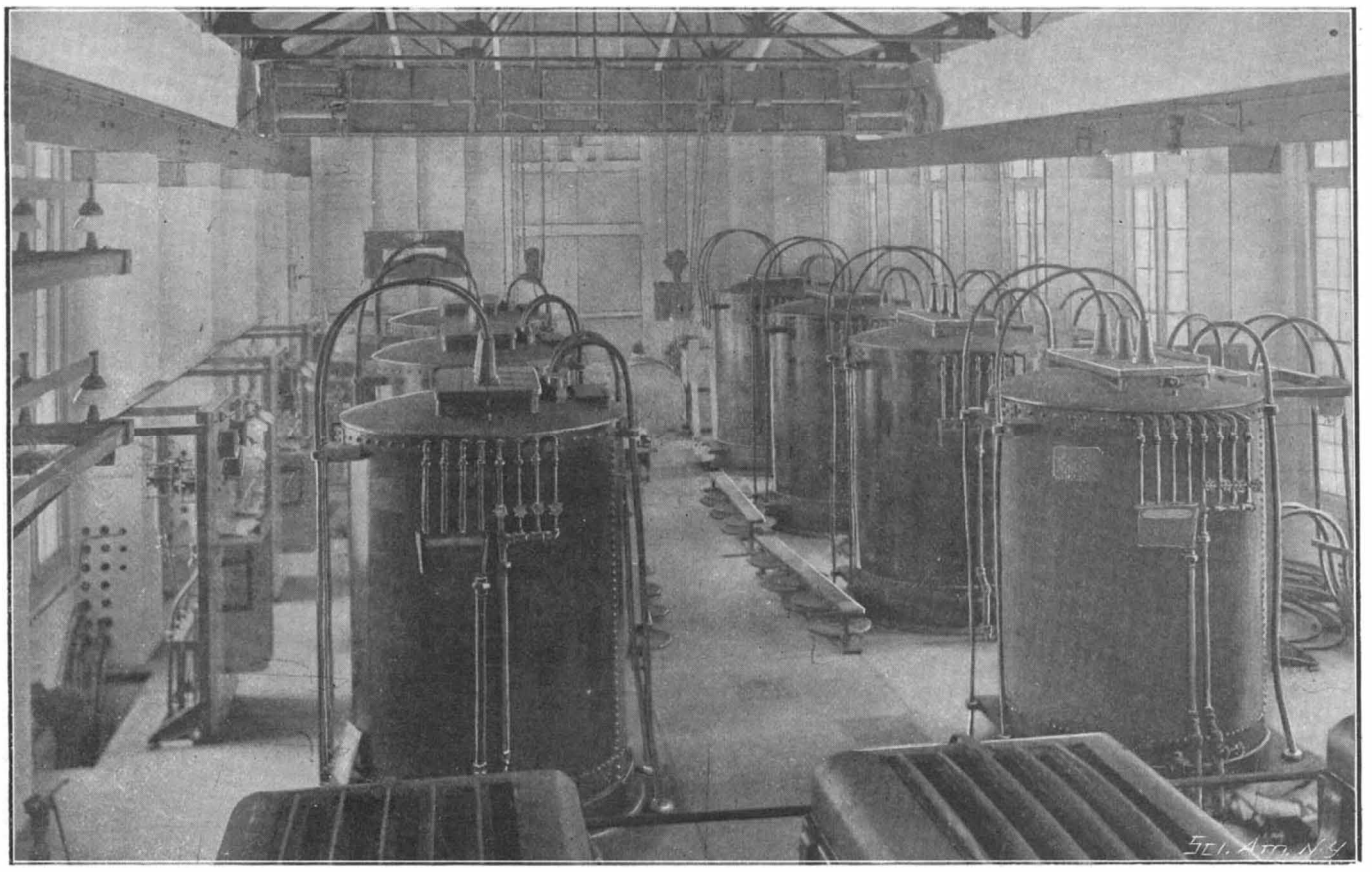
1.—High Potential Panels for Transformers.



2.—Lightning Arresters.



3.—Terminus of High Potential Bus-Bars, and Double-Throw Switches.



4.—Step-Up Transformers, 2,500 Horse Power Each, for Union Carbide Company.

RECENT DEVELOPMENTS AT THE NIAGARA FALLS POWER PLANT.

Several feet above these panels are the choke coils, also on wooden frames, and with six coils in series with each leg of the three-phase lines. The coils are wound spirally about a wooden core, with no metal parts to cause induced current and lower the choking effect of the coils. Each has five layers of soft, flat copper under one insulation of paper and cotton tape, with seventeen to nineteen complete layers. The choke coils are thoroughly soaked in insulating varnish and baked, and finally painted black. Where choke coils are used as in this case, they must be connected in circuit between the apparatus to be protected and the arrester. In the same room are located the circuit-breakers, as well as the converters for the ammeters, which are in a panel in the transformer room. The circuit-breakers are high upon the wall, having a long drop lever to rupture the arc. The floors of the transformer and lightning arrester rooms are of cement. The high potential switches are operated by means of a long hardwood pole, having a hook in the end to engage in an eye near the end of the switch blade.

The high potential marble panels in the foreground on the left of Fig. 1 receive the wires from the transformers. The converters for the high potential switchboard ammeters are back of the panels seen in Fig. 1. The switches are double throw. The bus-bar porcelain insulators are thoroughly tested for 60,000 volts.

Illustration No. 3 shows the terminus of the high potential bus-bars and two sets of bus-bar double-throw switches. Illustration No. 4 gives a complete view of the Westinghouse transformers for the Union Carbide transmission lines. Upon the floor is shown a group of choke coils with their framework, ready for mounting. The bus-bars for the transmission line are insulated with three layers of tape and two additional layers at the clamps, after being coated with insulating varnish and dried. This is then coated with liquid glass and soapstone, and afterward painted black. The framework is very neatly made, and substantial. The bus-bar switches are double-throw, and when either side is cut out, the switch-blade is closed upon the center connection to prevent accidental closing. The thick marble slabs effectually prevent arcing from blade to blade. The full capacity of the bus-bars, when complete, will be 25,000 horse power. The twenty General Electric air-blast transformers of 1,250 horse power each are all in place. The high potential switches are double throw; thus a line may be changed at will at either bus-bar.

The General Electric induction motors of eight horse power each, which have given excellent service in driving the blowers to cool the transformers, must, owing to lack of space and the demand for increased air supply, make way for two others of the same make, of twenty-five horse power each. All the wiring is done in the most approved manner, and is tested with 50,000 volts. The insulators in the air chamber are thoroughly secured by screws or bolts to the iron framework of the place. Exceptional care should always be taken in installing wires and bus-bars for high-tension circuits. They should be out of reach, when possible, to avoid mechanical injury. To accomplish this, they are universally placed ten to twenty feet above the floor, and leave the power house at the highest possible point. They should be in plain view, and rigidly supported on porcelain insulators. These bus-bars as shown are supported upon insulators of special design. In the air-chamber, where the high-tension cables from the transformers and from the high-tension panels cross each other, the crossing is effected in the most approved manner, special means being frequently necessitated.

Porcelain tubes are placed over each cable at the insulators, where iron brackets are in use. The cables are also run through porcelain tubes in the cemented floor, where they are brought up to the high-tension marble panels. With the introduction of the circuit-breakers on the high potential side, the time element circuit-breakers and fuses on the low potential side will be discontinued, and the panels remodeled. If, for any reason, the high potential circuit-breakers in the lightning arrester room do not act under short circuit, the emergency switch upon the switchboard will be depended upon to open the dynamo field circuit-breakers. It is, however, hardly possible that recourse will have to be made to the emergency switch.

The new step-up transformers for the Union Carbide Company, shown in illustration No. 4, are of Westinghouse make, oil insulated and water cooled. Each is of 2,500-horse power capacity, being twice as large as any others previously made. The cables from the power-house switchboards are first connected to the low-tension panels at the right of the transformer room, and, after proper connections to the switches and circuit-breakers, pass directly to the transformers, which take on their low-tension sides 2,300 volts two-phase, and deliver on their high-tension sides 11,000 volts three-phase. The cables are then connected to the high-tension panels at the left, from which they are carried in a subway to the works of the Union Carbide Company, a mile distant. Triplex lead-sheathed cables are used on these three transmission lines in the subway.

Raising Hungarian Grapes.

An experiment in raising Hungarian grapes is to be made near Norfolk, Va. Barth S. Lindsay of Norfolk, Va., is the projector of this experiment. He will at first plant three acres in these vines, and if, after three years, the experiment proves a success, he will establish a larger vineyard. Mr. Lindsay, who has had experience as a vine-dresser in Hungary, considers the climate and soil of this section favorable to the growth of these grapes.

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RODNEY HUNT TURBINE PLANT AT THE GREAT NORTHERN PAPER COMPANY'S MILL.

It is not always the largest industrial enterprises that are the most prominent in the public eye, and the truly enormous paper mill, whose hydraulic power plant forms the subject of our front page engravings, is a case in point. Located within the vast forests which lie in the northern parts of Maine, and far removed from the more active centers of industry, there has been constructed, during the past twenty-four months, a great establishment, which is considerably the largest plant of its kind in the world. The location of the mill at this particular point was determined by certain topographical features favorable to the development of hydraulic power. Two rivers—the Millinocket stream and the west branch of the Penobscot—form a junction at this point, and there is a natural difference of level a short distance above the point of their confluence of about 110 feet. The site chosen for the mill lies at a point on the Millinocket, just above and within the fork of the rivers, where the two streams are about a mile apart. A little further down, and before the streams unite, there is a fall in the Penobscot; and although the intervening country between the two streams is approximately level, the land falls suddenly to the valley of the Millinocket stream, and provides an admirable site for the mill, with the necessary difference in head for the development of water power. A dam was thrown across the Penobscot which raised the level of the water about 10 feet, and formed a reservoir of 250 acres' area on the high land between the two rivers, thus providing an excellent storage basin for the logs from which the paper is manufactured. The water is led from the Penobscot through a set of gates into a short canal which terminates in a head-bay, from which it is led by a number of steel penstocks down the slope of the hill to the paper mill.

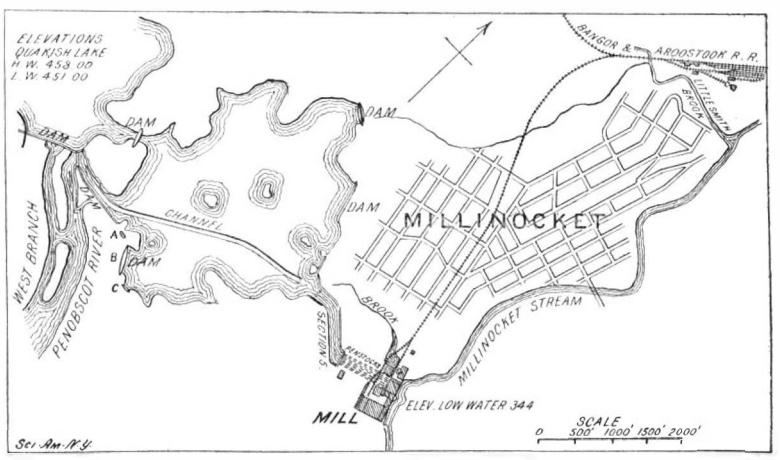
As it is the purpose of the present article more particularly to describe the hydraulic power plant, we will simply state that an adequate idea of the large amount of power required for the mill may be gathered from the fact that when the whole establishment is completed and in full swing, about 400 tons of paper will be turned out every day, and that over a third of a cord of wood will be worked into pulp every minute that the mill is in operation. The total cost of the whole plant was $2,500,000, and a further idea of its magnitude may be gathered from the fact that the 3,000 inhabitants of the town of Millinocket are all directly or indirectly supported by this enterprise.

After a careful consideration of the various methods of developing and utilizing the necessary power, it was decided to use water power in large turbines, direct-connected to grinding machines, for the important work of grinding the wood into pulp, and to use electricity developed by turbine-operated generators for driving motors suitably distributed throughout the other departments of the mill.

The contract for making and installing the hydraulic plant was given to the Rodney Hunt Machine Company, of Orange, Mass. (Boston office, 70 Kilby St.), who have equipped the power house with sixteen of their well-known new pattern Hunt turbines, of the horizontal type, with plain cylinder gates. The aggregate capacity of the turbines, as determined by the Holyoke tests, to which more detailed reference is made below, is about 22,000 horse power under the normal head. By far the greatest demand for power comes from the grinding room, where at present there are installed turbines of an aggregate of 15,600 horse power, and which, when completed, will contain a total of 23,400 horse power. This room, of which we present a half-plan, contains at present forty-eight grinders, which are arranged in four lines, twelve on a line. Down through the center of the grinding room runs the tail-race, and above it, each carried on a massive 5-foot wall of masonry, are four pairs of 57-inch turbines, each pair being placed at the center of its own line of shafting, with twelve grinders direct-connected to it—six on each side. The water is led to the turbines by four 10-foot steel penstocks, each of which is 1,000 feet in length, the whole set containing some 2,000 tons of steel. The penstocks pass into the building in parallel lines, and extend beneath the level of the floor until they enter the tail-race, where they make a bend of 90 degrees, entering the turbine casings at an inclination of 45 degrees, as shown in the lower drawing on the front page of this issue. The water passes centrally into the casings, flows right and left through the wheels, and leaves by pairs of draft-tubes, one on each side, which discharge at an angle of 30 degrees with the vertical into the tail-pits. The weight of the turbines, casing, etc., is carried by the 5-foot masonry walls above mentioned, while the tail-race is floored over with heavy I-beams, which serve to carry the standards for the main shafting bearings. The flooring of the I-beams is carried upon vertical posts which are placed in pairs, one on each side of each draft-tube, a girt being bolted in between each pair of posts, just below the level of the water, to carry the weight of the lower end of the tubes. Each pair of turbines as above described develops about 4,000 horse power when running at 225 revolutions per minute.

We also show on our front page a general perspective view and transverse sections of the generating room, in which there are installed three units, each consisting of a pair of 36-inch turbines, mounted on horizontal shafting in the same way as the 57-inch turbines in the grinder room. Each unit is direct-connected to a 1,000-kilowatt, 600-volt, General Electric Company's tri-phase generator. In front of these three units are two single 24-inch turbines, each of which is direct-connected to a 60-kilowatt exciter. These five turbines are supplied by a single 11-foot penstock, which extends centrally beneath them, the diameter of the penstock reducing as connection is made in turn to each of the turbines, a slide-valve gate being provided in each connection. The draft-tubes for the 36-inch wheels are carried down, one on each side of the penstock, to the tail-race; while the exciter turbines discharge at one side of the penstock, as shown clearly in the engravings. The exciter turbines also serve to operate two brass, 1,000-gallon underwriter fire-pumps, made by the Rodney Hunt Machine Company. These pumps are shown in the perspective view of the generator room, where they are arranged on the opposite side of the turbines to the exciters. They are provided with powerful, friction, grooved wheels by which they can be thrown in or out of gear, as desired. We also present a detailed view of one of these pumps.

The mechanism for controlling the cylindrical gates of the large turbines in the generator room consists of a hand-wheel on a horizontal shaft, mounted transversely across the turbine casing, which carries two pairs of machine-cut, sector, bevel gears, to which is attached a Lombard governor. Attention is also drawn to the regulators, made by the Rodney Hunt Machine Company, which are attached to the gate shafts, at the side of the 24-inch wheel cases. The regulator is of the duplex relay type, and acts directly on the gate. It is shown in detail in the small engraving above the general perspective view.



MAP SHOWING LOCATION OF MILLINOCKET MILL

Efficiency Tests.—Particular interest attaches to the tests for efficiency, which were carried out upon two of the turbines before they were shipped to Millinocket. The test was made at the flume of the Holyoke Water Power Company, of Holyoke, Mass. The 57-inch turbine showed an efficiency of 85.93 per cent at full gate; from ¾ gate to full gate it showed an average efficiency of 83.17 per cent. The 36-inch turbine showed an efficiency of 85.89 per cent at full gate, and an average efficiency of 84.70 per cent from ¾ gate to full gate, as compared with the guaranteed efficiency of 80 per cent from ¼ gate to full gate. The horse power guarantee was also exceeded considerably. This is certainly a very remarkable showing, particularly if we bear in mind that, on account of the exceptional head of 110 feet under which the turbines operate, the runner and guide chutes had to be made of steel and of unusual thickness, conditions which are not by any means conducive to high efficiency.

A simple form of Wehnelt interrupter has been devised by J. von Pallich, of Germany. The negative electrode is formed by a copper wire about 1-5 inch in diameter, and the positive electrode by a steel wire of 1-25 to 1-10 inch. These wires are surrounded up to their ends by glass tubes; the tube containing the steel wire is drawn out by the blowpipe so as to make a sliding fit with the wire. The two tubes are passed through a rubber stopper which fits in the neck of a one-pint glass flask containing dilute sulphuric acid. The flask is placed in a water-trough in order to avoid heating. The two glass tubes are closed at the top by rubber stoppers through which the wires pass. The steel wire fits snugly in its stopper and in this way its length in the tube is regulated. The wire is attacked somewhat rapidly when in action, but by lowering it by degrees, the proper length for working the interrupter may be maintained.

The Gold-Mining Industry of the Transvaal.

Now that the war in South Africa is rapidly drawing to a close, public attention is once more being directed toward the commercial and industrial development of the country, especially in connection with the gold-mining industry.

Some idea of the wealth of the country may be gleaned from the records of the gold mines during the past thirteen years, which, notwithstanding the fact that they have been hampered in their working by corrupt practices, yet have proved very prosperous. In the year 1887 only 23,125 ounces of gold were produced, but in the next year the quantity was multiplied nearly nine times, to 208,121 ounces. The prosperity continued to increase during the next four years, and the industry assumed such large proportions that endeavors were made with a view to simplifying the process of extracting the gold from the ore. There was also a proportionate heavy importation of machinery, in order to cope with the increasing industry. In the year 1892 was introduced the process which has completely revolutionized the work of gold mining, both with regard to quantity and celerity of output, economy, and cheapness. This was the cyanide process, followed by the treatment and concentrates of tailings, and the systematic sorting of waste rock. So successful was the new method that it is now adopted throughout the country with conspicuous success, and has since been introduced into the gold fields of Australia with equal satisfaction.

In 1892 no less than 1,974,354 tons of ore were mined, which yielded 973,291 ounces of mill bullion; 200,526 ounces from tailings and concentrates, and 37,051 ounces from banks and other sources, making an aggregate output of 1,210,868 ounces, with a value of $21,488,050.

The machinery for the production of the ore at the end of this year comprised 2,530 stamps, and 1,700 boilers, 730 of the latter of which were in operation at Johannesburg, while the others were distributed among the numerous other gold-mining centers throughout the Republic, representing a total value of about $10,000,000. The industry gave employment to about 3,500 whites and 30,000 natives.

But the industry has grown tremendously since 1893, despite the more stringent restrictions that were continually levied by the Republican government, and which considerably retarded the progressive development of the industry to anything approaching its possible capacity. At the end of the year 1897, 8,500 whites and 60,000 natives were at work in the mines. Heavy shipments of machinery, which had been considerably improved in both design, manufacture, and capacity of output, had been made. In December, 1897, no less than 2,282 boilers and 1,239 steam engines were in active operation. Electricity had also been introduced, both for lighting and power, with conspicuous success. Johannesburg, which is by far the most modern and enterprising city in the Transvaal, was supplied with 280 dynamos which provided light and power equivalent to 13,853,625 watts to 1,408 motors and nearly 33,000 lamps. The total value of the machinery and plant at work in 1897 was estimated to amount to $31,775,185. From the beginning of the year 1893 until the end of May, 1899, 17,531,562 ounces of bullion had been extracted, representing a sterling value of $305,488,135. It will therefore be apparent that, though the development of the industry in the past has been rapid, there is every augur of a much more successful and progressive era in the near future.

New Magnetic Observatory.

An interesting series of buildings has been erected at Cheltenham, Prince George's County, Md. This is the new magnetic observatory of the United States Coast and Geodetic Survey. Copper and brass are employed for all pipes and metal work, and the stove, which burns wood exclusively, is built of soapstone. The observatory is composed of two buildings, in one of which the magnetic influences on the compass will be measured. The instruments will be kept at a constant temperature of 65 deg. Fah. by means of a series of walls sheathed with thick paper, and other spaces are also provided. There are four sets of doors. The observatory is far away from any disturbing electrical influences, so there is no question that the observations will be most accurate.

The Bement collection of minerals and meteorites has been acquired by the American Museum of Natural History, New York city.

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Science Notes.

Hamburg's naval observatory has been removed to the village of Bergesdorf, as the smoke and vibration interfered with the observations.

A fine specimen of the periophthalmus family, a species of fish that is supposed to be confined strictly to African waters, has been caught near Fernandina, Fla.

Great Salt Lake is beginning to show the drain upon it, due to irrigation, and is receding. A canal to the lake from the head waters of the Snake River has been suggested as a possible remedy.

It is estimated that at an altitude of over 60 miles, the atmosphere will consist of 95 per cent hydrogen. It is suggested that this may be the source of the occluded hydrogen usually found in meteoric fragments.

Congress has under consideration the establishment of a psychophysical laboratory in the Department of the Interior for the purpose of prosecuting the exact studies on the criminal, pauper, and defective classes of our population.

A commercial museum is to be established in San Francisco on the lines of the Philadelphia institution. A company has been organized with Irving M. Scott as president. The idea is, of course, to benefit the commercial interests of California.

Venice is trying to revive the picturesque ceremony of wedding the Adriatic, which has been discontinued since the last Doge was expelled in 1797. Plans are being made for a new "Bucentaur" on the model of the one used in the last ceremony.

A party of Swedish naturalists under the leadership of Gustave Kolthoff made a northern voyage of more than usual length last summer, for the purpose of studying the fauna in Arctic waters and lands. They were disappointed in not finding any more relics of Andrée on Prince Charles Island.

It is feared that legislation regarding the Palisades may fail, owing to a lack of interest. Many seem to think that the saving of the Palisades is a local matter which, of course, it is not. A canvass of the legislators, especially those on the central and southern New Jersey shores, shows that there is need for a careful campaign of education.

M. Camille Flammarion, the celebrated astronomer, has been studying the effect of colored light on silkworms. White light yields the maximum, and blue light the minimum, production of silk. Next to white light, the purple of the red end of the spectrum gives the best results. Blue rays increase the number of males, and "warm rays" the number of eggs laid by the females.

A Roman dealer in antiquities obtained the permission of the Roman municipality to erect in the Piazza Borghese a replica of the famous Neptune fountain at Bologna by Giovanni Bologna. The city of Bologna enjoined the municipality of Rome and the author of the project from taking any such action, alleging, besides the legal precedents, the moral right of any city to guard its own artistic heritage.

It is reported on good authority that the Misses Newton, daughters of the late Prof. Newton, the famous Yale mathematician and astronomer, will soon donate to Yale for the Peabody Museum the great collection of meteorites and aerolites which their distinguished father collected through his life. The Misses Newton are at present traveling in Europe. The collection is stored in boxes, which were placed in charge of Prof. Brown at the Yale Observatory.

The Geodetic Commission of Switzerland has undertaken an exact leveling of the whole country by the most scientific methods. The work has been going on for many years. and from time to time atlas-sheets are published which give the general topography of a region accompanied by a list of the points whose altitudes have been accurately determined and by comparisons with previous work of the same sort. Each point determined is fully described so that, in its turn, it may serve as a datum point for more detailed work, and all the points are referred to one origin—namely to a monument in Geneva whose altitude above the sea has been fixed.

A barometer has been designed by Mr. K. T. Fischer for balloon observations, says The Engineer. It may be described as a Cartesian diver. The float consists of stem, cylinder partly filled with water, the free space being taken up by air, and bulb charged with mercury; it is made of glass, and swims in a brass cylinder containing distilled water. This cylinder is surrounded by a shell of ice, placed within a chamber packed with ice. The temperature being thus kept constant, the position of the float will depend upon the volume of the air intercepted in the float, which varies with the atmospheric pressure acting on the water in the brass cylinder. For exact determinations the stem is sealed off, and the cylindrical part weighed together with the bulb.

Engineering Notes.

Ten locomotives are being completed by the Baldwin Locomotive Works for the Paris, Lyons, Mediterranean Railway of France.

The "Ermak" will make another voyage into the Arctic regions next summer to test her efficacy against the polar ice. She has been furnished with a new, longer and more powerful stem, which it is supposed will enable her to break through ice of enormous thickness.

A solid mass of finest gray granite, measuring 68 feet long, 20 feet wide, and 14 feet deep, has been successfully blasted at the De Lank quarries, Bodmin. The weight of the block is about 1,400 tons. It is now being cut up into blocks averaging five tons each, which will be used in the erection of the new lighthouse off Beachy Head.

The Berlin International Exhibition for Fire Prevention and Fire Protection is to be held in June and July of this year in commemoration of the fiftieth anniversary of the organization of the Berlin fire brigade. The United States easily leads the world in fire protection if not in fire prevention, and it is to be hoped that our inventors will be adequately represented.

A workman in a German chemical works has invented a substitute for coal, which costs about 25 cents per 220 pounds to manufacture. Peat is the basis of the fuel. It gives out great heat, burns with a bright flame, and leaves no slag and only a small quantity of white ash. The peat is dried, ground by machinery, mixed with chemicals, and pressed into brick shape.

A patent recently granted gives the following formula for a metal-cleaning composition: Pure water, 1 gallon; potassium carbonate, 1 ounce; potassium cyanide, ½ ounce; sodium carbonate, ½ ounce; chloride of sodium, 1-10 ounce. The solution is used at the boiling point, and a strong electric current employed. A formation of gas takes place, which immediately separates all grease or other impurities from the object exposed and renders it chemically clean.

A large amount of money is being spent on the National Tehuantepec Railroad, which has been leased by the Mexican government to English contractors. Five thousand men are now employed on the railroad construction work and the harbor improvement works, and more than twice this number could be utilized, and a thousand Chinese are now on their way to Mexico to work on the road. The railroad is being rebuilt all the way from Coatzacoalcos, the Atlantic terminus, to Salina Cruz, the Pacific terminus. New eighty-pound steel rails are being put down, and twenty thousand redwood ties from California are being placed under the rails. There are also many native mahogany and ebony ties being used on the road.

Since 1890 seventy-three accidents have occurred with water-tube boilers in the French navy, of which number forty-four were due to rupture of the tubes, says The Engineer. Seventeen of the tubes which failed were in the bottom row. Six fractured tubes belonged to the second or third row from the fire, while on the top row, where the evaporation is complete, there were six tube collapses, eighteen more being credited to the intermediate rows. Thirteen of the accidents were traceable to abnormally low water level, and bad circulation accounted for six of the others. Six tubes split because they were worn out, and six because they were defective.

The Japanese government propose in future to construct their own battleships and to manufacture their own armor plates. They are projecting enormous shipyards and the installation of modern plant. Tenders have been issued for the machinery for the manufacture of armor. This decision is rather disconcerting to the big shipbuilding firms of Great Britain and the armor-plate manufacturers of Sheffield, since some of the largest and most recent additions to the Japanese fleet have emanated from the English yards. The armor-plate manufacturers have received millions of dollars during the past few years for the supply of armor plates. In the largest Japanese battleships, such as the "Asahi," there are no less than 3,000 tons of steel protection which cost over $500 per ton.

The trustees of Purdue University are recognizing the fact that certain classes of locomotives will soon be thrown into the scrap heap to make way for later and more economical types, and they desire to preserve good examples of the disappearing types, and the university authorities have asked for the co-operation of railway companies. The proposition which the university makes is a most liberal one. It offers to meet the transportation charges and to care for the locomotives thus deposited, which will still be owned by the railroad company. Three engines have so far been secured. One of them is that class of engine which first performed the transcontinental trip; the second is of the B. & O. camel-back type; the third is an English engine which was exhibited at the World's Fair of 1893, which has since been in the possession of the Chicago, Milwaukee & St. Paul Railway. A suitable museum building will probably soon be provided.

Archæological News.

The walls of Avignon are threatened, and the council has voted to destroy a part of them.

A special organ devoted to the papyri has been started. It is the Archiv für Papyruserforschung, and Prof. Wilcken, of Würzburg, is the editor.

A Roman chariot has been found near Philippopolis, Bulgaria, in a tumulus. All the metal parts of the chariot and the harness were found, as well as arms and human remains.

It is reported that a wealthy resident of Baltimore, a collector of pictures, has bought the Madonna of the Candelabra, of Raphael, at a very high figure. It is a superb picture, and is in a good state of preservation.

Mr. Lacey has reported a bill to provide for the setting aside of a "Cliff Dwellers' National Park" in New Mexico. The nearest railroad station to this proposed park is at Espanola, on the Rio Grande Railway.

Material from the excavations at Copan, in Honduras, is steadily accumulating at the Peabody Museum, Cambridge, Mass. The museum has been able to complete in this prehistoric city its investigations of the great hieroglyphic stairway on the face of the pyramid. Molds have been made of all the steps, with their carvings and inscriptions.

The Baptistery of Florence is being restored. A year ago the Cathedral authorities thought that the building looked too old, and ordered it to be cleaned with pumice stone, thus removing the rich, velvety color which rendered it so charming. The Cathedral authorities also desired "to clean" the base of the Campanile. Foreign public opinion is being aroused. The bad taste and vulgarity of the modern Italians are never shown to greater disadvantage than when some building is singled out for barbarous restoration.

Greek divers who have explored the sea bottom near the island of Cerigo have made discoveries of no little interest, both to the archæologist and the artist. Marble and bronze statues, fragments of vases, pieces of wood from some vessel, have been found, which indicate that here a trireme, laden with art-treasures and bound for Rome, was wrecked. Lucian, moreover, in his story of Zeuxis, mentions a vessel which Sulla had laden with statues and sent to Italy, and which foundered on these very coasts. Whether the vessel discovered be that referred to is questionable. The coincidence, however, is certainly remarkable.

Among the pieces brought to the surface may be mentioned the bronze head of a boxer or wrestler, and particularly the marble statue of a bending youth, which probably ornamented the pediment of some temple. The upper part of the statue is in an admirable state of preservation. The head and trunk are entirely intact. The two hands have also been recovered, one of which, still unfinished, is a veritable masterpiece. Although the statue has not been everywhere finished with equal care, it is nevertheless a work of art, remarkable for its rare grace and beauty.

The fall of two of the stones of the outer circle of Stonehenge, on the last evening of the nineteenth century, directs attention to the necessity for at once taking steps to preserve this remarkable phehistoric monument. The stones ought to be replaced while their original positions are clearly remembered, and before public interest in their fall has subsided. An engineer, writing to The Times, suggests a method of undermining the stones and imbedding them in a foundation of concrete or cement.

The Rev. Dr. William C. Winslow, vice-president of the Egypt Exploration Fund, says that in addition to the papyri from Oxyrhycus presented by the society to several universities, there is a valuable lot of forty-three papyri from several sites which have been received for distribution, largely treating of business and civil matters in the first centuries of our era. Among seven papyri for Columbia is a tax collector's returns, showing items and how the collectors made returns in A. D. 196. These were poll taxes in A. D. 122. In the papyrus for Hamilton College is the receipt for a voter named Philoxenus. One of two papyri for Vassar College is the official notice of the birth of a son from Ischyras and his wife, Thaisarion, A. D. 150, which is valuable for comparison with papyri at Berlin, which show how registry of births was then made. Of six papyri for Princeton one is a return of house property, A. D. 131, from Sambous to Dius and Herodes, keepers of the registry of property. The rise of the Nile was the greatest annual event, and upon it taxes were calculated. Hence one of the six papyri sent to Johns Hopkins, treating of the unwatered land tilled by Ptollarous, A. D. 163, is peculiarly interesting. She declares that her field at Euhemeria did not get the water. Her plea in a word is: "No crops, no taxes."

Our consul at Rouen considers that there is a great future for ice-making machinery, refrigerators, ice cream freezers, electric fans and kindred articles in France. Rouen, with a population of 150,000, has no ice plant.

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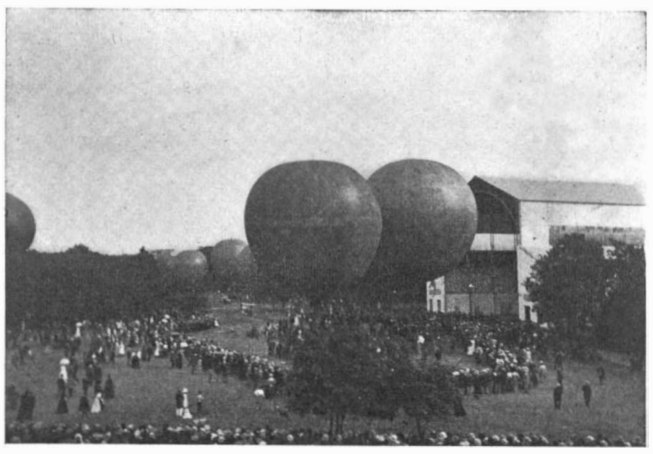
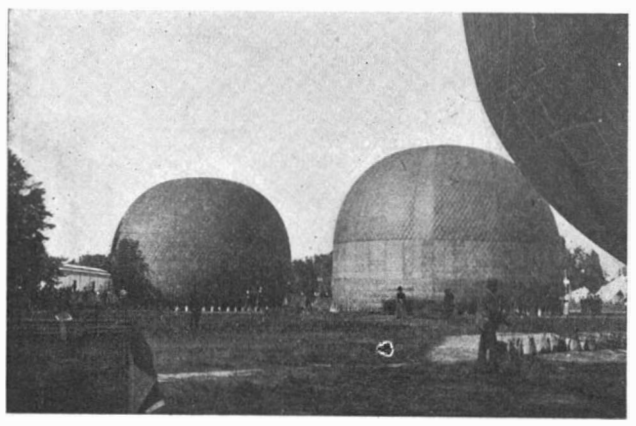
BALLOONS AT VINCENNES.

The illustrations presented herewith are reproductions of photographs taken at the first aeronautical *concours* held during the recent Paris Exposition at Vincennes. From the 17th of June to the 9th of October, 156 balloons, all of French make, varying in gas-capacity from 3,000 cubic meters (105,945 cubic feet) to 350 cubic meters (12,360 cubic feet) were exhibited at the aerostatic park of the Exposition, and made ascents with 327 passengers. Never were so many balloons collected in a single spot. To fill the numerous gas-bags 196,927 cubic meters (6,993,862 cubic feet) of gas were required. One hundred and fifty-eight ascents were made without any accident. On September 16, twenty-six balloons, inflated with 23,311 cubic meters (823,228 cubic feet) of gas, were sent up from the grounds. This was a noteworthy day at the Exposition so far as the number of balloons was concerned. The record for the longest balloon ascension is held by MM. Henry de la Vaulx and Castillon de Saint-Victor, who remained in the air for 35 hours and 47 minutes, and landed in Russia after having traveled 1,935 kilometers (1,202 miles). It has been suggested that the aerostatic park at Vincennes be preserved; but a permanent park could be maintained only by holding each year a *concours* somewhat on the order of the automobile and bicycle shows which have made Vincennes a favorite resort for sportsmen of late years. For the photographs reproduced herewith, and our information, we are indebted to M. Louis Bereau, a well-known aeronaut, who, on the ever memorable 16th of September, made a 15 hour ascent.

A BALLOON ASCENT.



THE AEROSTATIC PARK AT VINCENNES.



INFLATING THE GAS BAGS.

A NEW PILE-DRIVER.

The Chicago, Milwaukee and St. Paul Railway Company, finding it necessary to employ a pile-driver which could be utilized, not only in connection with the ordinary maintenance of bridges, but also in times of emergency, intrusted one of its engineers with the task of designing such a pile-driver. Mr. Willies E. Smith, of the Engineering and Bridge-building Department of the road, Chicago, Ill., recently patented a machine which fully answered all requirements. The improved driver can be used in renewing old piles, as well as in quickly repairing breaks in a burnt or injured bridge. In the latter emergency it is necessary that, without track-supports, the pile-driver should be able to reach far enough ahead to drive a bent to support the further end of a set of stringers, so that when rails have been laid on the newly-driven portion, the pile-driver can advance to drive the piles for the next bent. On the Chicago, Milwaukee and St. Paul Railway pile-driver, designed by Mr. Smith, this extension has been secured in a very simple and ingenious manner.

For the pile-driver in question a 45-foot car is employed, two extra truss rods being placed under the car to prevent sagging, and the transoms of the truck being extended beneath the outer sill of the car-body. To the top of the transoms a heavy plate carrying a jack-screw is riveted. The screw can be turned up against the car-sill to prevent side-tipping. Only when the leaders are swung far out from the center of the track are these jacks needed. In order that the pile-driver may be coupled to any train, the leaders are so proportioned that they do not project beyond the car when lowered, and the driving deck is equal in length to the car. The highest point of the pile-driver itself is 16 feet 8 inches above the top of the rail.

By means of a capstan connected by chain gearing with a sheave at the center of the driving-deck, a vertical shaft is operated provided with a pinion which engages a rack along the side of one of the center car-sills. Thus the driving-deck is moved. In order to permit a back and forth and a swinging movement, an intermediate deck is provided, between the 5-inch channels of which are located a number of 5-inch wheels traveling on 1 inch plates secured to the top of the car-sills.

In order to raise and lower the leaders a novel construction is employed, which comprises a pair of quadrant rockers forming part of the framework of the leaders. As the rockers pass from a horizontal to a vertical position, they roll on the deck, and elevate the leaders.

The leaders are supported at the apex of a four-cornered tower, 20 feet above the deck. Two legs of this tower consist of a pair of angles over the front corner of the deck, and an oblique ladder behind, and are matched by two members serving the same purpose. The fixed portion of this tower is the "A" bent in front, the rockers with their radial struts, the platform seven feet above the deck, and two rear braces from this platform up to the apex of the tower. That portion of the rear braces which extends from the platform down to the deck is hinged and jointed to permit the rocker to roll back when the leaders are to be lowered. Pins are used as connections. The rear brace folds up like a jack-knife, but at no time is the tie between the apex of the tower and the deck of the driver entirely broken. Hence the leaders and framework cannot clear the end of the driver if carelessly raised.

The tread for the rocker is a T-shape, with the head laid on the deck. The rocker itself consists of two plates with a filler between, one plate riding on each

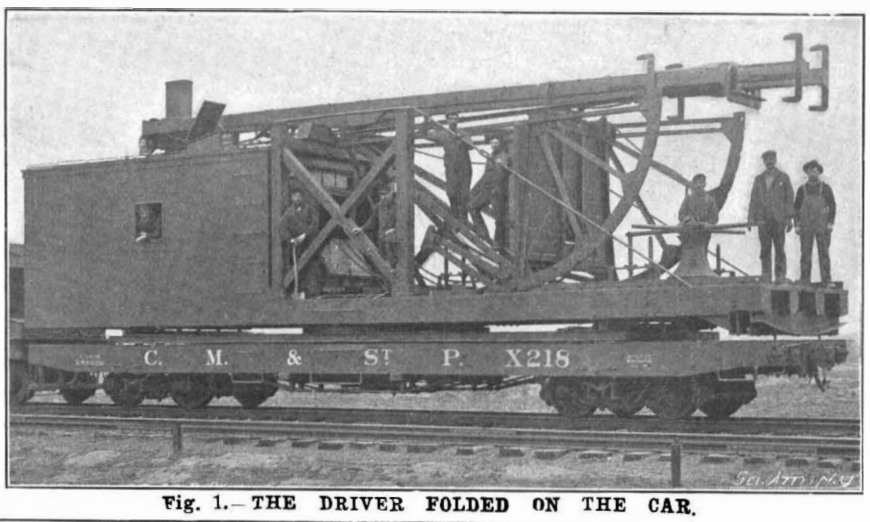


Fig. 1.—THE DRIVER FOLDED ON THE CAR.

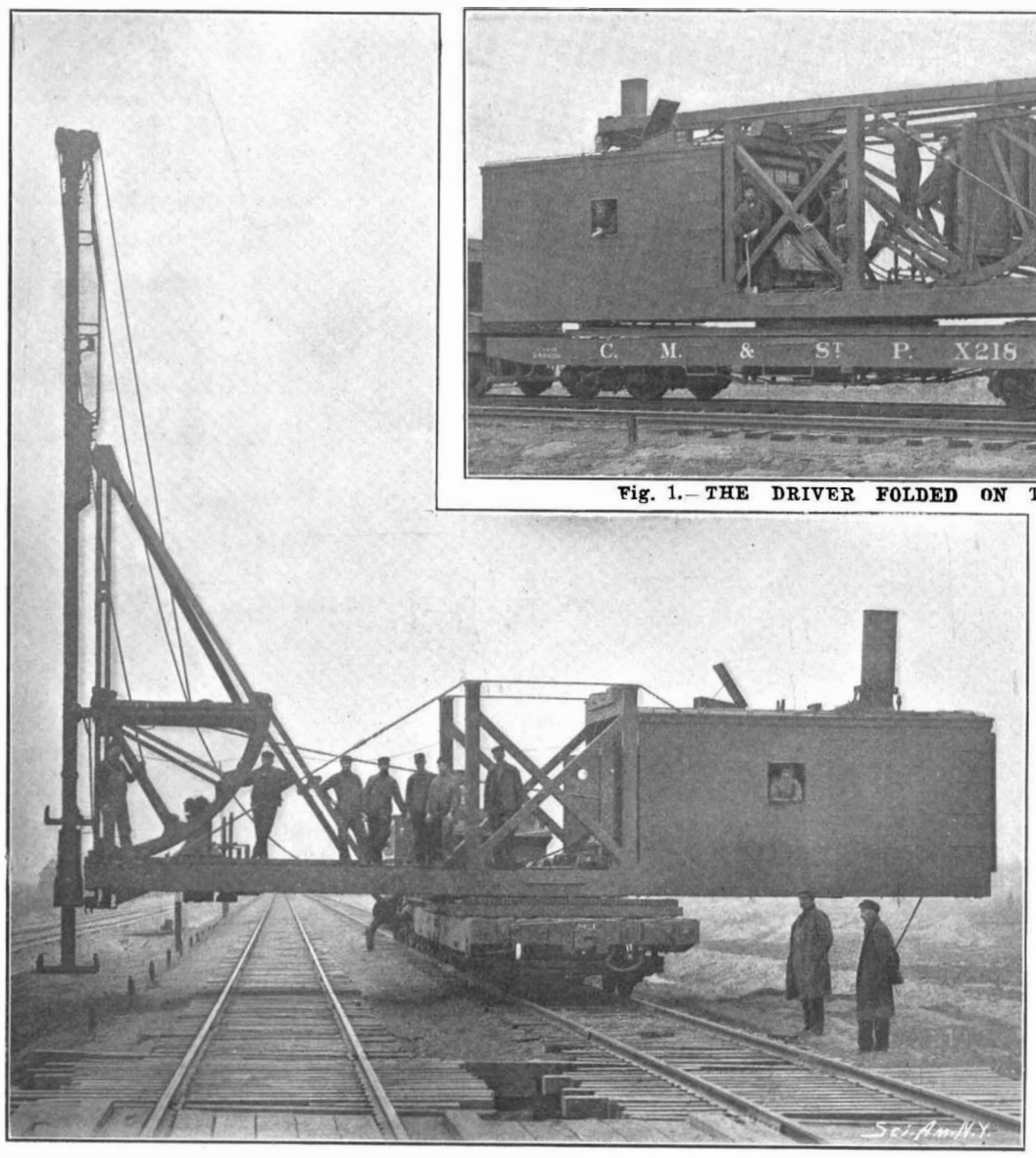


Fig. 2.—DRIVING DECK SWUNG ACROSS THE CAR.

Fig. 3.—LEADERS BATTERED.

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side of the upright leg of the "T." So nicely are the leaders balanced that with very little power they can be moved from either the horizontal or the vertical position.

For extension work the deck of the pile-driver can be moved forward until the center of the leaders is 18 feet beyond the center of the front car wheels. The deck is swung by pinions which engage circular racks attached to the intermediate deck. At each end of the intermediate deck is a segmental rack, and at the center is a complete circular rack, by which the deck can be swung clearly around. The ends, while over the intermediate deck, are partly supported and enabled to move freely by rollers; but after having swung clear, the deck is balanced by the equal distribution of the load. Fig. 2 shows the pile-driver swung at right angles across the car, in which position the center of the leaders in this position is 22 feet 6 inches from the center of the railway track. The weights on the deck are so adjusted that the center of gravity is never outside of the 9-foot circle on which the deck rests. In this position a pile can be picked up and driven with perfect safety.

Some nine years ago Mr. Smith found that he could dispense with the special drivers used for emergency repairs in driving the piles for the temporary support of through truss bridges by attaching an additional swinging set of leaders to the head block of his regular driver. Thus he was enabled to drive a pile close to the lower chord of a through truss bridge without swinging the deck of the driver out far enough to interfere. The swinging leaders proved so serviceable that he has incorporated them in the driver under discussion. Swinging leaders, besides dispensing with special drivers, are of great value in giving the outside piles of bents a good batter and the bents wide bases.

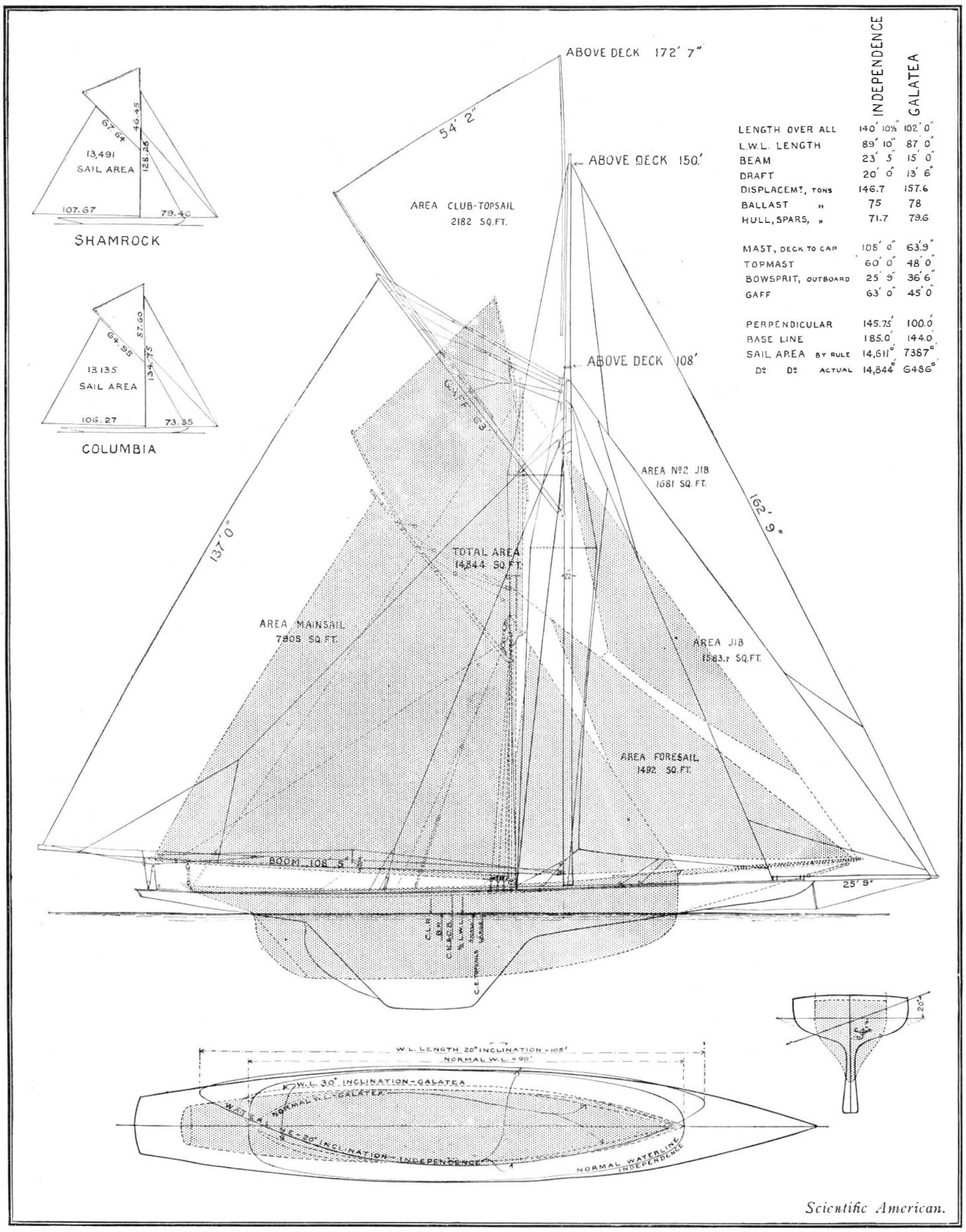
The Smith pile-driver is compact, easily coupled by the usual means with a train and is self-contained in every respect. The leaders can be raised and lowered by men on the car. The driver will drive piles in all places and under all the conditions encountered in railway service.

Adopts Baggage Check System.

The Great Eastern Railway, of England, will introduce the baggage check system on its lines on June 1. A small fee will be charged, but the adoption of the system by the passengers is optional with them. The Caledonian Railway is having thirty large steel cars built at Leeds and twenty in America with the object of comparing results.

FIFTEEN YEARS' DEVELOPMENT OF THE 90-FOOT RACING YACHT.

In pursuance of their commendable policy of satisfying the very natural and perfectly proper public curiosity as to what manner of yachts are being put afloat for the defense of the "America" cup this year, Messrs. Lawson and Crowninshield, the owner and the designer of "Independence," have furnished the SCIENTIFIC AMERICAN with the sail plan of "Independence" which is herewith reproduced from the original blue-prints. At the same time, by the courtesy of J. Beavor Webb, the designer of the famous old "Genesta" and "Galatea," we are enabled to present the sail, sheer and deck plans and midship section of the latter yacht, these plans being also reproduced from the original working drawings.



FIFTEEN YEARS DEVELOPMENT OF THE 90 FOOT RACING YACHT.

As shown by a comparison of "Galatea" (cutter, 1886) and "Independence" (cutter-sloop, 1901).

(Reproduced by the courtesy of the designers, J Beavor Webb and B. B. Crowninshield, from the original working drawings.)

It will be fifteen years ago this summer since the 90-foot cutter "Galatea" (her actual water-line length was 87 feet, but she classes with the 90-foot "Independence") came across the Atlantic to make the second attempt on the part of the typical English cutter to secure the "America" cup. She and her sister the "Genesta" may be said to have opened the latest period of the cup contests, a period which nas been far the most brilliant in the history of this memorable and long-drawn-out struggle. Although her genial owner, Lieutenant Henn, one of the most thorough English yachtsmen that ever crossed the water, sailed "Galatea," not merely in the cup races, but throughout the yachting season of the following year, she did little to add to the prestige of her predecessor, "Genesta," whose performance stands to day as the most creditable among the many English yachts that have competed for the cup. We have chosen the "Galatea," however, for this comparison, because on the basis of water-line length, by which the modern racing yacht is classed, she lends herself admirably to comparison with the 90-foot "Independence" of 1901. In our drawing, the cutter of 1886 is thrown in shadow upon the cutter-sloop of 1901, and the two drawings being exactly to the same scale, they tell the story of the development which has been taking place during the past decade and a half better than would a whole volume of verbal description.

Speaking in a general way, it may be said that among the many conditions surrounding the cup contests, there is only one, at least as regards the dimensions of the yachts, that is strictly negative, and this is the rule that neither yacht must exceed 90 feet in length on the water-line. They may be as deep, as broad, as long on deck, as their respective designers may care to make them, but in length, while they may be many feet less than they must not be a fraction of an inch over, 90 feet. Subject to this restriction, then, the problem is to design a yacht which shall carry a maximum amount of sail upon a hull that shall have the smallest possible displacement and wetted surface, and shall present the easiest form to drive through the water. At the time of the "Galatea" - "Mayflower" races, the American and English yachts were widely different in form, the English cutter being of narrow beam and considerable depth of body, the American sloop being of shallow draught and great beam, and depending upon the movable centerboard to give her the proper lateral plane when sailing by the wind. The initial stability of the sloop was large, the center of buoyancy moving out rapidly to leeward as the vessel heeled, and thus automatically, as it were, maintaining the margin of stability. In the narrow cutter, the initial stability was small, the center of buoyancy moving to leeward but little as she listed, although the righting moment increased rapidly with every increase in the angle of heel. On equal displacements, the greater initial stability of the sloop enabled her to carry a considerably larger sail plan, and hence in light winds she was invariably faster than the cutter. At higher speeds, however, the finer form of the cutter showed to advantage against the bluffer lines of the sloop; there was less wave-making resistance and, hence, in the second race

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between "Genesta" and "Puritan," which was sailed in a piping breeze, the cutter was practically a match for her shallower-bodied competitor.

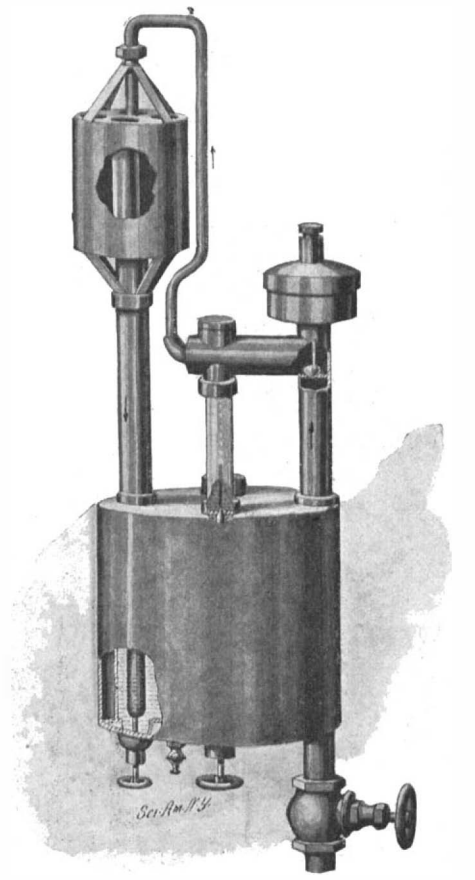
The narrow beam of the cutter was due to an English rule of measurement which put a heavy tax upon beam, but none upon draught. As soon as this was removed, and a rule of measurement based on water-line length and sail area substituted, the English designers reverted to the more generous breadth of the original cutter type, the "Thistle" having a beam of 20 feet 3 inches to a length of 86 feet 6 inches, as against the "Galatea's" beam of 15 feet on a length of 87 feet. The "Valkyrie II." of 1893, which, with her sister the "Britannia," may justly be termed the type from which the modern racing craft has sprung, showed on a water-line length of 85 feet, a beam of 22 feet 6 inches, and a depth of 17 feet 6 inches. Simultaneously with this lowering of the lead and widening of the beam, the forefoot was cut away, the sternpost and rudder brought well forward of the after end of the water-line, with the result that the wetted surface and, therefore, the frictional resistance of the yacht was considerably reduced.

On the American side, development had been in the direction of deeper draught and a lowering of the center of gravity, until in "Vigilant," the competitor of "Valkyrie," we see a boat with the enormous beam of 26 feet and the deep draught, for a sloop, of 13 feet 6 inches. With such a draught it was evident that the days of the centerboard were over, and in the next yacht, "Defender," Herreshoff produced a keel boat of similar contour to "Valkyrie," but with even 2 feet greater draught than that yacht. It was at the time of the "Valkyrie"-"Vigilant" races that the forward and after overhangs of the racing yacht began to be carried out far beyond the load water-line, and so great has been the development in this direction that in the "Independence" we have a forward overhang of 27 feet 5½ inches and an after overhang of 23 feet 5 inches. These exaggerated overhangs have the advantage of compensating for the increase in beam, (compare the deck plans of "Galatea" and "Independence") by permitting the fore-and-aft lines to be practically as fair and easy as those of the old cutter type.

It will be seen in the comparison of the midship sections that the modern yacht embodies two points of excellence of the cutter and sloop, for it has the low center of gravity of the one and the high center of buoyancy of the other. The bottom of the lead of the "Independence" is 6 feet 6 inches lower than that of "Galatea" and her beam is 8 feet 5 inches greater. Thanks to her great length, her lines are at least as easy, and by carrying the flat floor of the hull well out into the overhangs, Mr. Crowninshield has secured the unmistakable advantage that when the yacht is heeled, even in a moderate sailing breeze, she lengthens her water-line from 90 to 105 feet. The cutter, on the other hand, lengthens but little; as will be seen by comparing the listed water-line of both yachts. The comparison is not made on the same degree of inclination, for the reason that the relative tenderness of the cutter would cause her to heel about 30 degrees in a breeze which would only incline the cutter-sloop by 20 degrees. With her straight stem the cutter, of course, gains nothing when heeled forward and her gain aft, at the given inclination, is not more than a couple of feet.

In considering the form of "Independence," as shown from the midship section, we must bear in mind not only that she possesses all the initial stability of the sloop type due, as we have seen, to great beam and shallow body, but that the height of the center of buoyancy, when the yacht is heeled, is increased by the great lengthening of the water-line and consequent submersion of the full ends of the yacht, as shown in the plan of the listed load water-line. Under 20 degrees of heel, the center of buoyancy of the submerged portion of the hull moves out to leeward until it is 2.75 feet from the vertical axis of the boat and only 2.83 feet below the normal water-line. Compared even with "Columbia" she shows in this respect a remarkable gain; and it is probable, moreover, that the center of gravity of the boat is lower than that of the last cup defender. That this is the case is suggested by the fact that "Independence" will spread 1,476 square feet, or 11 per cent, more sail that "Columbia," although the displacement of the latter vessel is greater.

The increased power of the cutter-sloop over the cutter is not, however, to be all attributed to form and disposition of weights; for a corresponding gain has been made both in the materials and methods of construction. Looking at the hulls of the two boats, as shown in outline and in shadow, it is seen that although her displacement is less, in bulk or cubical capacity "Independence" is enormously larger than "Galatea." She is 39 feet longer on the deck, 8½ feet greater in beam, her deck area alone being 2¼ times as great as that of "Galatea." Although nominally in the same class by virtue of her water-line length, "Independence," measured by her actual superficial area, is a vastly bigger boat. The same disparity is present in the spars and sails. Nevertheless, as will be seen from our comparative table of dimensions, the total weight of the hull, spars, rigging, sails, etc., of the bigger boat is less than that of the cutter by 8.9 tons, or 11 per cent—a structural paradox which tells more eloquently than words the story of the advance which has been made during the past fifteen years, not merely in the quality of the materials themselves, but in their scientific adaptation to the problem in hand. Doubtless "Galatea" as designed by Webb embodied the latest ideas in the way of lightness of construction known at that date to the naval architect. Her hull was of steel, but the deck was wood-planked, and the spars were solid throughout. Although she was lightly constructed, as things went in those days, nothing was sacrificed to the determination to make her a perfectly stanch and seaworthy vessel; and doubtless to-day she could snug down and thrash her way, without starting a rivet or loosening a spar, through a gale that would send "Independence" or in fact any of this year's 90-footers to the bottom. Still, the "America" cup contests are not supposed to be, or, at any rate, have had the luck never as yet to be sailed in a gale of wind. Therefore "Independence" is a perfectly proper and legitimate craft for the work she is called upon to do. Allowing then that stanchness has been somewhat sacrificed to lightness, as compared with the cutter, we may still attribute the remarkable lightness of "Independence," both in hull, spars and sails, to the far greater strength per unit of weight of her materials of construction, and



THE SLATER LUBRICATOR.

to the great care which has been exercised to dispose this material to the best structural advantage. To particularize, we may mention the substitution of nickel-steel framing and Tobin bronze plating for the mild steel frames and plating of the "Galatea;" the substitution of steel and aluminium plating for the heavy wood deck; and the use of plough steel, having a strength that runs pretty close to 100 tons to the square inch, for the standing rigging; and the substitution of hollow steel and hollow wooden spars for the solid pine sticks which were used on the earlier boat.

It must be confessed that the sail plan of the "Independence" is very impressive. We were prepared for an increase over that of the last contestants, but not for such an increase as this. The ring or cap of the mainmast is 108 feet and the topmast is 150 feet above the deck, while the head of the topsail will be 172 feet 7 inches above the same level. What these dimensions are can best be realized when it is stated that were "Independence" to range alongside the center of the Brooklyn Bridge, the topmast would be level with the passenger foot-walk, while the peak of the club-topsail would tower 20 feet above the top chord of the trusses. Compared with "Shamrock" and "Columbia" it will be noticed that the gain in sail area has been in the direction of greater height. The base line from end of bowsprit to end of boom is only 3½ feet greater than that of "Columbia," and is, indeed, 4 feet less than that of "Shamrock." In height, however, there is a gain of 11 feet over "Columbia" and not less than 17½ feet over "Shamrock." The English yachting journals are crediting "Shamrock II." with a base line of 185 feet which is exactly that of "Independence," and a mast measurement of 148 feet. It is not stated whether this measurement is over all or whether it is from the deck. The "Shamrock's" boom is given as 112 feet or 3½ feet longer than that of "Independence," but as the measurement from the forward side of the mast to end of bowsprit of "Shamrock" is said to be 71 feet, as against 74.5 feet in "Independence," it is evident that the mast of "Shamrock" is to be placed several feet further forward and that she will probably show a larger area in her mainsail.

AN IMPROVEMENT IN LUBRICATORS.

Our illustration represents a simple lubricator, by means of which the lubricant is kept warm and flowing to insure a thorough lubrication of the parts. The inventor of the lubricator is Charles Slater, 76 Commercial Street, Portland, Me.

The device comprises a jacketed oil-cup, a space being provided for hot air to warm the oil. The air-space is heated by steam passed through a pipe connected either with the steam-chest or throttle. The steam-pipe passes through the air-space referred to, and at its upper end communicates with a horizontal mixing-chamber. The connection between the steam-pipe and the mixing chamber is controlled by a spring-pressed valve. The pressure of the steam passing through the pipe is sufficient to force the valve from its seat; and the spring seats the valve when the steam is cut off. A sight-glass connects the mixing-chamber and the oil-cup; and a needle-valve regulates the passage of oil from the cup to the mixing-chamber.

From the mixing-chamber a pipe leads upward and then downward into the top of a condensing-cylinder, through which cold-air flues pass to condense the steam. The water of condensation passes down through a pipe leading to the bottom of the oil-cup; and the opening at the lower end of this pipe is controlled by a screw-valve.

As the steam passes up through the steam-pipe, the valve at the upper end of the pipe is forced open by the pressure. The steam then passes through the mixing-chamber to the condenser, and is condensed. The condensation passes down into the bottom of the oil-cup and displaces a certain quantity of oil. The displaced oil passes up through the sight-tube and downward through the steam-pipe to the parts to be lubricated. Sediment or water may be removed from the oil-cup by a pet-cock.

Prehistoric Mines.

The prehistoric mines at Hartville, Wyoming, have been examined by Prof. George Dorsey, Curator of the Columbian Museum, Chicago, who finds that the Indians, in addition to working the mines, were also extensively engaged in manufacturing various instruments. Around the village the ground was strewn with fragments of flint and partly constructed arrows, lances, hammers, etc., showing that the people who worked these quarries carried on the manufacture of household and warlike instruments near at hand, the finishing being done by the women and children, in their lodges, while the men were at work quarrying. Dr. Dorsey will spend the summer in making further investigations.

The April Building Edition.

The Building Edition for April is filled with interesting matter, and the illustrations of houses are of a uniform excellence. "The Appellate Court-House, New York City," is the subject of an elaborately illustrated article. "The National Arts Club, New York City," is accompanied by interesting engravings showing the gallery and grillroom. The selection of houses at various prices is noteworthy. "Why Some Houses Are Good" is the editorial. The "Interview" this month is with Mr. William A. Boring. The departments are filled with interesting matter, including a critical review of Mr. Sturgis' new "Dictionary of Architecture and Building."

The Current Supplement.

The current Supplement, No. 1319, is of unusual interest. "The Restoration of the Castle of Milan" is accompanied by a number of interesting engravings. "The Termination of the Trials of Count von Zeppelin's Airship" gives a most graphic account of the interesting experiments. "Paris Automobile and Cycle Show" was written by our Paris correspondent. "The Anderson Ship Railway" describes a new plan. "Thomas Henry Huxley" is by Leslie Stephen. "The Distribution of Marine Invertebrate Animals" is a lecture by Prof. Henry A. Pilsbry, and was specially reported for the Scientific American Supplement.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

FORK FOR HANDLING SHEAVES. — LEWIS C. STURMAN, Ninemile, Mont. The purpose of the invention is to provide a fork especially adapted for handling sheaves; but also adapted for use as an ordinary pitchfork. The improved device has, therefore, in addition to the ordinary fork, which is movable or may be locked, clamping hooks or arms, which, as the main fork is forced into a sheave automatically close around the sheave, means being provided for opening the arms at will.

LAND-MARKER. — FRANCIS M. ENGLE, Sweetwater, Ill. This land-marker may be readily applied to any seeding or planting machine, and has a simple means for raising and lowering the land-marker. The implement may be operated by a person without leaving his seat, thus saving much time and labor.

HARROW.—JOHN B. GEBHARDT, Petersburg, Iowa. The novel feature of this invention is to be found in a hinge which so connects sections of a harrow that they can be extended rigidly or folded one on the other to reduce the size of the harrow when desired.

Railway Appliances.

MAIL-BAG CATCHER.—CHRISTIAN G. SORENSON and WILLIAM T. ALDEN, Grand Island, Neb. The mail-bag catcher which has been devised by these inventors is designed to deliver bags respectively from and to a car, and to avoid the necessity of throwing the bag from the car to the ground, by providing mechanism for catching the bag which is delivered from the car and holding it safely until removed by an attendant.

Vehicles and Their Accessories.

WHEEL FOR HORSELESS CARRIAGES.—JOHN CAULFIELD, Brooklyn, New York city. It has been the inventor's purpose to provide means for enabling the pneumatic or rubber-tired wheels of motor-vehicles to grip the ground firmly so as to prevent slipping when traveling over mud, ice or snow. To attain this purpose the wheel is provided with teeth or projecting gripping members at each side of the rubber tire, which gripping members, if it be so desired, may be projected or retracted by means of a lever mechanism operated by the occupant of the carriage.

Mechanical Devices.

MACHINE FOR DRIVING SCREW-EYES.—EDMUND SATHER, Brooklyn, New York city. Through the medium of this tool screw-eyes can be readily placed in positions which have hitherto been reached with difficulty. The screw-eyes are held in a magazine and are successively fed to an end of the tool and held firmly in position while entering the object, and conveniently released from the tool after being fixed in position. The tool can be operated by one hand.

ANIMAL-TRAP.—JAMES W. BARNES, Beaverton, Ore. This animal-trap is especially adapted for trapping moles and gophers, which burrow along slightly below the surface of the ground. The tripping-bar of the trap may be set with its lower end in front of the hole. When the gopher finds his way blocked he immediately begins to stop up the hole, throwing dirt down in front of the tripping-bar and going back for more until he has accumulated enough. By pushing the accumulated dirt forward, he will move the tripping-bar and release detent devices which hold a spear. By adjusting the tripping-bar in its connection with a trigger-lever the trap can be readily set for a long or a short animal.

WINDMILL.—ROBERT A. NICHOLL, Marlette, Mich. This direct stroke windmill has a head-block which turns in a support, and which carries a spindle secured at one side of its longitudinal center of rotation. The windwheel is mounted to turn on this spindle, and is provided with an eccentric groove in its hub. On the head-block a crank-shaft is mounted, a member of which enters the groove in the wheel-hub. A pump-rod is located at the center of rotation of the head-block; and an arm is attached to the crank-shaft and connected with the pump-rod. Since the spindle on which the windwheel is mounted is at one side of the center of the pipe through which the pump-rod passes, the wheel is capable of governing itself; for when the wind reaches a certain height the wheel will swing around out of the wind.

ACETYLENE-GAS GENERATOR. — WILLIAM G. ROSS, Benicia, Cal. This generator has in connection with a receiver or gasometer, a number of generators and a means for automatically placing the generator in operation after the carbid of a previously operated generator has been exhausted. The discharge from the generators is automatically controlled to conform with the rate of consumption.

HOISTING OR LOWERING DEVICE FOR BOATS.—SAMUEL BERGSTEIN, Manhattan, New York city. The invention is an improvement in the class of davits which are so hinged as to be adapted to swing outwardly into horizontal position to launch the boat. Each of the davits is hinged to the deck, so that they may swing outwardly. The boat hung from these davits has a gunwhale provided with notches to receive the davits. Tackle detachably connects the davits and boat for holding the latter immovably on the davits until required for service.

ACETYLENE-GAS GENERATOR. — JACOB H. WILLERS, Manhattan, New York city. The generator is arranged automatically to feed the carbid into water, to generate gas in measured quantities according to consumption and to permit the immediate removal of the carbid residue without interrupting the working of the machine, and without danger of the passage of air into the machine or the escape of gas therefrom.

EXERCISING-MACHINE.—EMIL R. ERNST, Manhattan, New York city. The object of the inventor is to provide a device which will not only bring into action and exercise all the muscles of the body, but will also afford amusement and pleasure. With these ends in view Mr. Ernst has devised a machine which, when manually operated, has a teetering and rotary motion.

BURNISHING-MACHINE.—JAMES B. CAROLIN, Newark, N. J. For burnishing cheap metal caps, buttons, and like articles without the aid of skilled labor, the present burnishing-machine is especially adapted. The machine has a tool post with a guideway in which the burnishing tool slides and turns. The tool-post is adjustable to bring the burnishing tool into desired angular position relatively to the chuck holding the article to be burnished. The sliding movement of the burnishing-tool in the tool-post is limited by a stop on the tool.

Miscellaneous Inventions.

NON-REFILLABLE BOTTLE. — LEON F. BIZOUARNE and EMIL KUGLER, 34 Rue des Appennins, Paris, France. The inventors broadly employ the siphon principle to prevent the refilling of bottles. A siphon is inserted in the mouth of the bottle and controls the flow of liquid, the outer end of the siphon-tube extending inwardly. The outer end of an air-vent extends inwardly beyond the outer end of the siphon-tube.

HAT-STAND.—JOHN F. KENNEFICK, Cripple Creek, Colo. This invention relates to that class of hat-supporting stands employed for the display of hats in show-windows. Mr. Kennefick has provided a novel, simple device of this character which is better adapted for the support of stiff or soft hats in different positions than the hat-stands ordinarily employed.

STAYSAIL-RIGGING. — PETER J. MCDONALD, Noank, Conn. The purpose of this invention is to provide means for mounting stay-sails on vessels, particularly the jib-topsails of fore-and-aft rigged vessels, so that the sail may be set firmly at the luff and held at the clew in such a way that it will be allowed to yield to unusual strain, thus easing the rigging and spars, and particularly the topmast.

SKETCHING INSTRUMENT.—THOMAS A. MCFARLAND, Chicago, Ill. The frame of the instrument has two mirrors arranged at an angle to each other and provided with a peep-hole. The frame can be adjustably secured to an inclined drawing-board and held so that the larger mirror will at all times be parallel to the board. The reflecting angles are fixed one relatively to the other. By the employment of this device a landscape or an object can be easily and accurately drawn on paper or canvas.

PROCESS OF MANUFACTURING LIME AND CARBONIC ACID.—GUSTAF M. WESTMAN, Manhattan, New York city. The object of this invention is to provide a new and improved process for manufacturing lime and carbonic acid in such a simple and economical manner that both the lime and the carbonic acid are almost immediately in condition for the market. The process consists essentially in passing a mixture of highly-heated carbonic acid and steam up through a column of limestone to expel the carbonic acid contained in the limestone and to convert the latter into calcium oxid. The expelled carbonic acid is then charged with water to cause the heat of the carbonic acid to convert the water into steam and thereby reduce its temperature. A portion of the cooled carbonic acid charged with steam is conducted into a regenerator and highly heated and used in turn for expelling carbonic acid from the lime. Calcium oxid is drawn from the base of the column.

ANTISEPTIC BROOM.—OSCAR S. KULMAN, Box 209, Savannah, Ga. Mr. Kulman, who is well known as the inventor of several antiseptic brooms, has made a decided improvement in the invention with which his name is particularly associated. Formerly he employed only a single retainer to hold antiseptic material. In the present invention he has provided a double retainer, made of two bags connected by wires and held in the broom by the rows of stitching through the straws, which stitching is made to cross the wires so that the retainers are held by the stitching. The bags are not perforated by the stitching.

Designs.

KETTLE OR POT-SCRAPER. — GUSTAV HOFFMAN, Yonkers, N. Y. The pot-scraper is a plate having a curved edge and a straight and curved edge. A hole in the center offers a means for the insertion of the hand.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 359.—For machinery for making mailing tubes.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 360.—For manufacturers of gold extracting machinery.

Brass Cups, Threaded. Bliss Chester Co., Prov., R. I

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Building Edition for April, 25 cents.

Inquiry No. 362.—For manufacturers of presses for pressing sawdust into shapes.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 363.—For a cuff holder which fastens to the coat sleeve.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 364.—For a manufacturer of small experimental hydraulic pumps.

Rushton Boats and Canoes. Morris Canoes. The H. & D. Folsom Arms Co., 314 Broadway, N. Y.

Inquiry No. 365.—For parties who sell an absolutely water-proof parchment paper.

SAWMILLS.—Variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 366.—For dealers in model chains, chain wheels, gears, etc.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

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Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 141 Varick St., N. Y.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 369.—For a machine for peeling potatoes, about 150 pounds per day.

For Sale.—Right to take out foreign patents on my invention, Suspender End Attachment, U. S. patent to issue May 4, 1901. Address C. H. Dome, Prescott, Ark.

Inquiry No. 370.—For machinery for manufacturing twin wooden pocket combs.

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Inquiry No. 371.—For modelers' tools for pottery models.

The best book for electricians and beginners in electricity is "Experimental Science." by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 372.—For aluminium manufacturers making small tubing for pencils.

Wanted.—Skilled artist in mechanical art work. No one need apply who has not a knowledge of mechanics coupled with artistic ability and experience. Address Artist, P. O. Box 773, New York.

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Inquiry No. 374.—For manufacturers of stamping machines.

Inquiry No. 375.—For hand dies for making punchings for small motors and dynamos.

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Inquiry No. 380.—For targets for a mechanical shooting gallery.

Inquiry No. 381.—For parties to make an adding machine.

Inquiry No. 382.—For fans with power generated from storage batteries or springs.

Inquiry No. 383.—For small friction buckles such as used on roller skates.

Inquiry No. 384.—For the address of the makers of lompo board.

Inquiry No. 385.—For manufacturers of portable houses.

Inquiry No. 386.—For parties to make a patent oyster case consisting of wooden outer case and cover lined with galvanized iron, and inner case of galvanized iron—could substitute aluminium.

Inquiry No. 387.—For manufacturers of compressed paper for car wheels and wood fiber for making trunks; also for manufacturers of aluminium.

Inquiry No. 388.—For the manufacturers of Dewey steel armor for hose.

Inquiry No. 389.—For the manufacturers of a pulverizer and automatic sampling machine exhibited at the World's Fair.

Inquiry No. 390.—For small patent suitable for mail order business.

Inquiry No. 391.—For folding opera glasses.

Inquiry No. 392.—For manufacturers of eyelets and eyeleting machinery.

Inquiry No. 393.—For parties to manufacture a new, improved coal-dumping wagon.

Inquiry No. 394.—For manufacturers of gas meters attachable to gas wells.

Inquiry No. 395.—For manufacturers of malleable iron castings.

Inquiry No. 396.—For manufacturers of electric furnaces for burning brick.

Inquiry No. 397.—For manufacturers of an electric machine for taking and finishing a tintype at one operation.

Inquiry No. 398.—For parties to make a hair clamp of steel wire and nickel.

Inquiry No. 399.—For a machine for making a wire clothespin.

Inquiry No. 400.—For machinery for the manufacture of hames.

Inquiry No. 401.—For manufacturers of irons for ironing hames.

Inquiry No. 402.—For manufacturers of automobiles with four seats for carrying twelve people.

Inquiry No. 403.—For machinery for making thread spools.

Inquiry No. 404.—For manufacturers of rotary cement furnaces.

Inquiry No. 405.—For parties to make a separable steel carpenter's square.

Inquiry No. 406.—For parties making blank knives, forks and spoons ready for plating.

Inquiry No. 407.—For manufacturers of sheet copper and brass.

Inquiry No. 408.—For manufacturers of castings for kerosene and gasoline motors suitable for a bicycle.

Inquiry No. 409.—For parties to forge out bridle bits and spurs from spring steel.

Inquiry No. 410.—For parties to draw brass tubing to a point about ⅜ or ½ inch long, with the point smooth, or a No. 24 wire gage hole in the end.

Inquiry No. 411.—For manufacturers of tools for making cigarette boxes.

Inquiry No. 412.—For a manufacturer or dealer in "Mocking Bird" fire alarm whistles.

Inquiry No. 413.—For manufacturers of laundry machinery.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(8153) D. Mc. C. writes: 1. A says that a certain amount of gas from water decomposed by electricity can be used in a motor of some kind (steam or explosive) driving an electric water-decomposing apparatus and the same amount of gas produced that was used to produce it. A. The amount of gas produced will depend upon the efficiency of the apparatus. It cannot equal the amount that was used to produce it, until perpetual motion has become an accomplished fact. We need not say that that will never be accomplished. Nor do we see any reason why one should think that *half* the amount of gas should be produced. Some percentage of the gas can be produced. What percent, we do not know. 2. A says that in decomposing water by electricity the gas can be confined in the apparatus as it is produced (like steam in a boiler) up to a high pressure. In regard to the first question, B says that only half the quantity of gas would be produced. To the second, he says the apparatus will not produce the gases when the pressure is above 15 pounds per inch above the pressure of the air. Question 1—How much gas would be produced? Question 2—How high a pressure in producing? A. We have no doubt that a very high pressure can be produced in this way. Whether it was ever tried, we do not know. It would be easier to try it than to discuss it.

(8154) E. C. K. asks: Is it true that objects exposed to sunlight absorb light which is radiated at night, and to what extent? A. The sulphides of barium, calcium, and some other substances, when properly prepared, have the property of shining in the dark after they have been exposed to the light. When these are applied to a surface as a paint, the property may be made useful. A clock face painted with this paint will be visible from all parts of a room at night. The property is called phosphorescence. The paint loses its luminosity after some hours in the dark, but regains it upon exposure again to the light. Such paints have been known for a long time, but have not come into any extensive use.

(8155) F. A. R. asks: I wish to make a dry battery. On what do the battery constants depend? Does the size of both zinc and carbon affect the voltage? Is there any rule for determining the voltage? A. The amperes of a cell depend upon the size of the plates and their distance apart, the liquid employed, its concentration, in one phrase, the internal resistance, and the resistance of the external circuit. The voltage depends upon the materials used. In a dry cell these are zinc, carbon, and sal ammoniac in solution with water. The voltage is about 1½ volts. The voltage of a dry cell is the same as that of a Leclanche cell. The size of plates has nothing to do with the voltage.

(8156) W. C. H. writes: Please give me an estimate of the current that passed through my body from one hand to the other, under the following conditions: I had hold of one leg of direct incandescent line, current 104 volts 120 amperes, and accidentally

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touched a bare place in a series arc line, the machine having on 56 lamps at 48 volts per lamp, and running at 9.6 amperes, one machine direct current, 104 volts, 120 amperes; one machine, series arc, T.-H. system, 2,680 volts, 9.6 amperes, with slight grounds on each line. I was "knocked all in a heap," as the saying goes, and both hands badly blistered. A. The resistance of the human body is a very uncertain quantity. Sometimes it seems higher than at others in the same person. It certainly is not the same in different persons. It may vary from 10,000 ohms down to 300 ohms when the skin is moist. It is thought to average 2,500 ohms. If that was your resistance, you had about one ampere through you for a short time. It is not probable that you had so much current through you, and lived to tell how it felt.

(8157) P. S. asks: Can you tell me what the Edison wax records are made of, or of something that will answer in place of the above? What is the best mixture to fill a dry battery composed of? A. The composition of the Edison record cylinders has not been disclosed. There is nothing known which answers the purpose so well. Dry cells are filled with a mixture of sal ammoniac, water, plaster of paris, and often some material to keep the whole porous. Each kind probably has a different composition.

(8158) L. E. asks: Does the Toepler-Holtz machine get its initial charge from the friction of the brushes which rub upon the buttons on the plates, or does the machine generate electricity as soon as the plates are revolved, regardless of any first charge. A. The friction of the tinsel brushes upon the metallic balls fastened to the revolving plate gives to the balls and the brushes charges of opposite kind. Thus the machine is made self-exciting. Otherwise a charge must be put upon the brush from some generator before the machine will start. Glass plates revolving in the air will not of themselves generate electricity.

(8159) G. P. F., Jr., asks: 1. Why does cream rise, being heavier than the remainder of the milk? A Cream rises to the top on milk because it is lighter than the rest of the milk. Cream is an oil, and oil floats on water because it is lighter than water. The rest of the milk is water, with lime and other substances in it. It is, therefore, rather heavier than water. 2. Give an example of the affinity of chlorine for a metal. Would $Sb + 2Cl = SbCl_2$ be the proper answer. A. Yes. The question calls for a substance which combines directly with chlorine. Antimony, finely powdered, if sifted into perfectly dry chlorine gas, will combine very rapidly with it.

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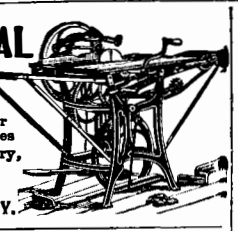

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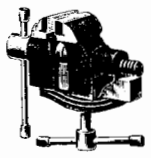

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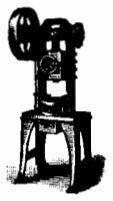

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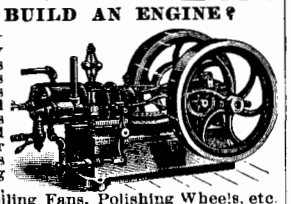

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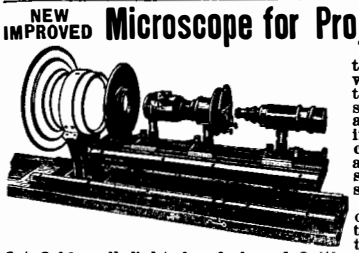

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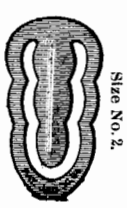

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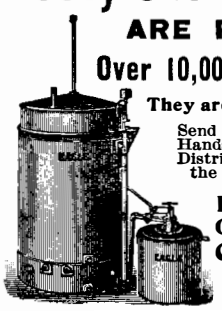

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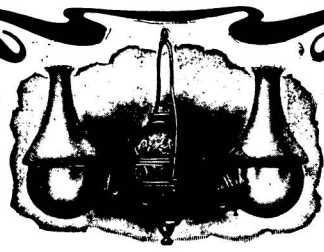

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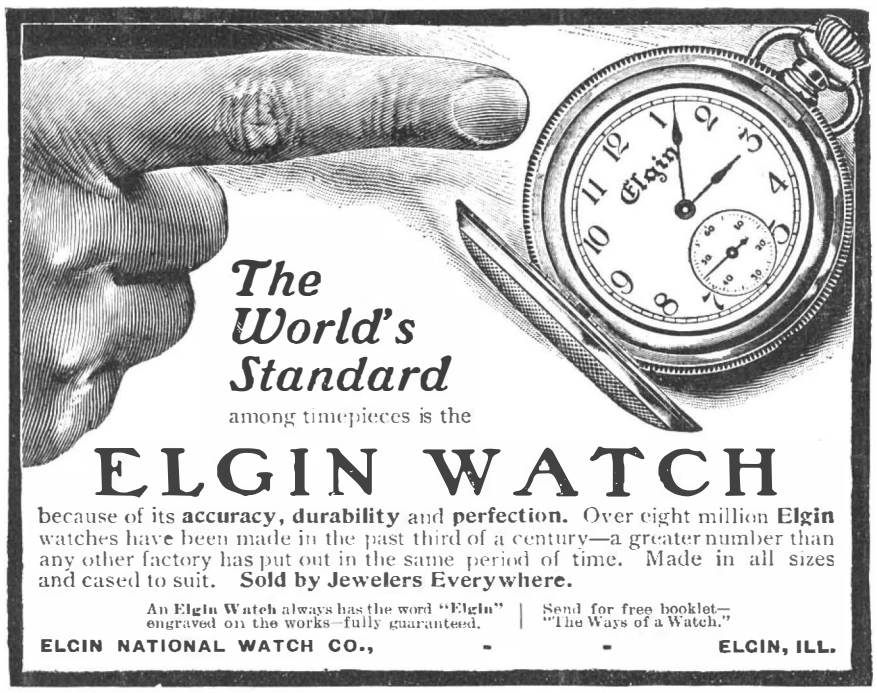
(Continued on page 238)



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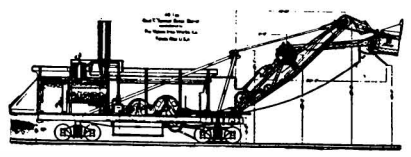

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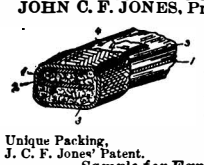

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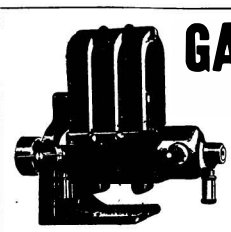

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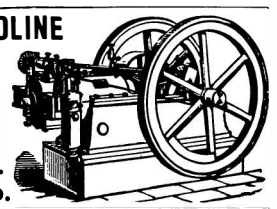

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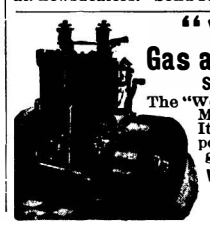

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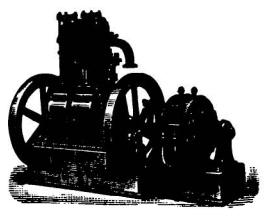

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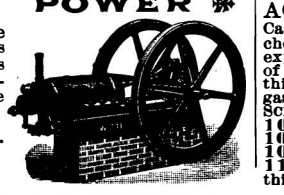

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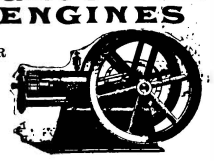

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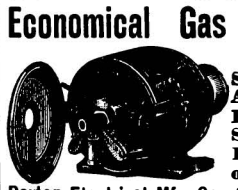

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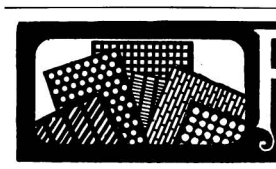

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COMMISSION
NEW EAST RIVER BRIDGE,
CITY OF NEW YORK.

NOTICE TO CONTRACTORS.

April 4, 1901.

Proposals will be received by the Commissioners of the New East River Bridge, at their office, at No. 258 Broadway, in the Borough of Manhattan, in the City of New York, at two o'clock in the afternoon of the 25TH DAY OF APRIL, 1901, endorsed "PROPOSAL FOR CONSTRUCTION OF THE STEEL SUSPENDED STRUCTURE OF THE NEW EAST RIVER BRIDGE." for furnishing the materials for and constructing the steel suspended structure of the New East River Bridge, in accordance with the proposed form of contract and the drawings and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to Lewis Nixon, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the said Commissioners on that day at two o'clock in the afternoon.

Copies of the specifications and the general drawings for the work, with the proposed forms for the bid, bond and contract, may be obtained, and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Borough of Brooklyn, City of New York, on and after the 8th day of April, 1901.

The Commissioners require that all bidders shall carefully examine the specifications, drawings and proposed form of contract, in order that no question as to their meaning may arise hereafter. It must be distinctly understood that no changes in the quality of the materials or of the workmanship will be allowed, and that the specifications will be adhered to strictly.

The contract is to be completely performed within eight months after the receipt by the Contractor from the Engineer of written notice to begin the erection of the suspended structure.

Bids will be made upon a form provided therefor, and only those bids will be considered which are complete, in proper form, comply with the requirements herein stated, and are offered by parties of known reputation, experience and responsibility.

Each bidder will be required to deposit, with his proposal, in the office of the Commissioners, a certified check for $10,000, payable to the order of Julian D. Fairchild, as Treasurer of the New East River Bridge Commissioners, as security for the execution by him of the contract and the giving of the required bond, if his bid is accepted, within two weeks after notice of the acceptance of his bid.

Bidders are required to state in their estimates, under oath, that such estimate is made without any connection with any other person making a bid or estimate for the same purpose, and that it is in all respects fair, and without collusion or fraud, and also, that no member of the Municipal Assembly, Head of a Department, School Commissioner, Chief of a Bureau, Deputy thereof or Clerk therein, or other public officer, is directly or indirectly interested therein, or in the supplies or work to which it relates, or in any portion of the profits thereof, as principal, surety or otherwise. The estimate must be verified by the oath, in writing, of the party making such estimate, that the several matters therein stated are in all respects true.

The Contractor will be required to give a bond in the sum of $300,000, in the form annexed to the proposed form of contract, with an approved surety company doing business in the City of New York, conditioned for the prompt and faithful performance of the contract and its covenants and the work thereunder.

As by far the greater part of this work can be executed only by bridge establishments of the first class, bids will be received only from such parties as have the requisite plant and facilities. The bidders must be, in the opinion of the Commissioners, fully qualified both by experience and in appliances to execute work of this character and importance according to the highest standard of bridge work at the present time.

The Commissioners reserve the right to reject any and all of the proposals offered, and to accept any bid offered.

LEWIS NIXON,
President.

JAMES D. BELL,
Secretary.

WANTED.—STRUCTURAL STEEL-WORK Draftsmen. An examination of applicants will be held at the Navy Yard, Washington. D. C., April 18, 1901, for two structural steel-work draftsmen at $5.04 per diem, Bureau of Yards and Docks, Navy Department. The examination will be open to all comers who can give evidence of experience in the kind of work for which they seek employment, and who are citizens of the United States. Applications will be addressed to the Commandant, Navy Yard, Washington, D. C., and must be delivered to him on or before Wednesday, April 17. No application received after that date will be considered. Each applicant will state in his application his name, age, residence, citizenship, present occupation, and previous employment or work done. The applications will be accompanied by evidence of citizenship, and by certificates, preferably from previous employers, as to character, habits of industry and sobriety, and skill and experience in work of the kind required.

JOHN D. LONG, Secretary of the Navy.

WANTED –DRAFTSMAN-IN-CHARGE. AN EXamination of applicants will be held at the Navy Yard, League Island, Pa., April 16, 1901, for draftsman-in-charge at $6.00 per diem. The examination will be open to all comers who can give evidence of experience in the kind of work for which they seek employment, and who are citizens of the United States. Applications will be addressed to the Commandant, Navy Yard, League Island, Pa., and must be delivered to him on or before Monday, April 15. No application received after that date will be considered. Each applicant will state in his application his name, age, residence, citizenship, present occupation or work done. The applications will be accompanied by evidence of citizenship, and by certificates, preferably from previous employers as to character, habits of industry and sobriety, and skill and experience in work of the kind required.

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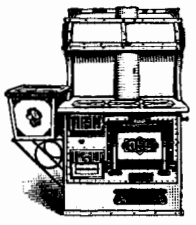
Wire stretcher, A. Davison	670,928
Wrench, G. A. Musselman	671,143

(Continued on page 239)



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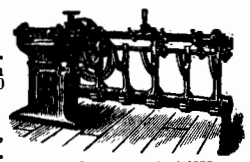

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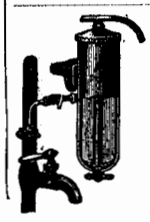

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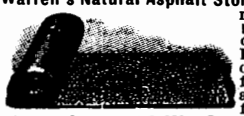

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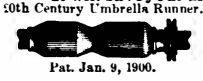
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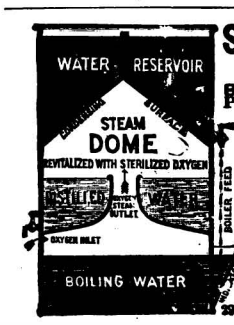

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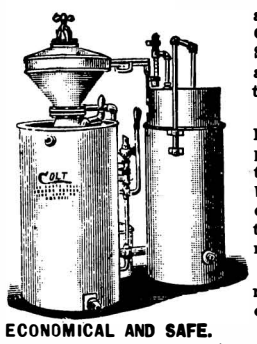

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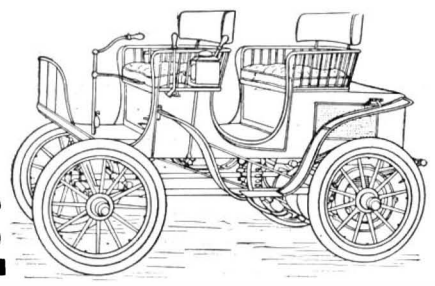

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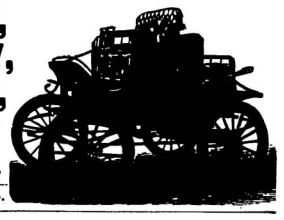

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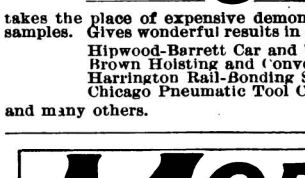

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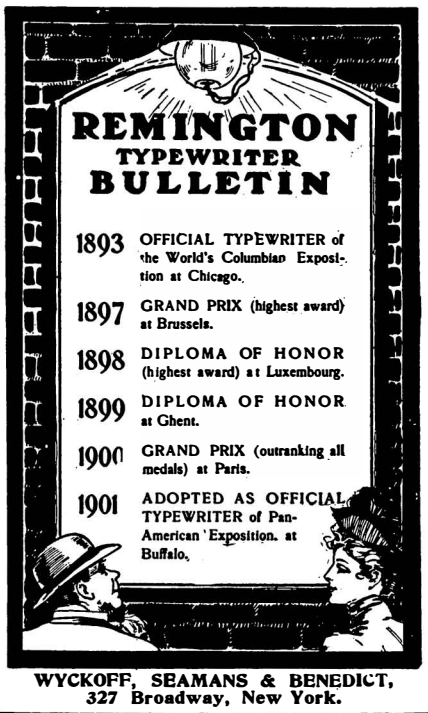
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